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FINAL FEASIBILITY STUDY FOR OPERABLE UNIT 4 (OU 4) SITE 1 NIROP ROCKET CENTER WV

11/1/2013

CH2M HILL

Final

Operable Unit 4
Site 1 (OU-4) Soil Feasibility Study

Allegany Ballistics Laboratory
Rocket Center, West Virginia

Contract Task Order WE13

November 2013

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Under the

CLEAN 1000 Program
Contract No. N62470-08-D-1000

Prepared by

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Chantilly, Virginia

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Executive Summary

This Feasibility Study (FS) report was prepared by CH2M HILL under the Department of the Navy (Navy), Naval Facilities Engineering Command, Mid-Atlantic Division, Comprehensive Long-term Environmental Action, Navy (CLEAN) 1000 Contract 62470-08-D-1000, Contract Task Order WE13. This FS report documents the analysis and evaluation used to develop remedial action objectives (RAOs) and remedial alternatives to address potentially unacceptable risk in soil at Site 1, Operable Unit 4 (OU-4), at the Allegany Ballistics Laboratory (ABL), in Rocket Center, West Virginia. The activities described herein are part of the overall Installation Restoration Program for ABL being implemented by the Navy, with regulatory oversight by the U.S. Environmental Protection Agency, and the West Virginia Department of the Environmental Protection.

Site 1 is an 11-acre area situated adjacent to the North Branch Potomac River along the northern border of the developed portion of Plant 1 at ABL. Site 1 has been used for various types of waste-burning and historical disposal activities. Based on current and historical site activities, Site 1 has been divided in two geographical divisions, the Active Burning Ground (ABG) and Outside Active Burning Ground (OABG). The ABG consists of several historical disposal units within an 8-acre fenced parcel. The ABG is also is currently used for burning reactive wastes and is operated under a Resource Conservation and Recovery Act (RCRA) permit (permit number WV0170023691). Since Site 1's inception in 1983, several environmental investigations have been conducted there. Numerous soil, groundwater, surface water, and sediment samples have been collected and analyzed for a variety of parameters to assess the site's condition during these investigations. Because of its complexity, Site 1 has been investigated as two OUs: OU-3 for groundwater, surface water, and sediment and OU-4 for soil. A Record of Decision was signed in May 1997 for OU-3 (CH2M HILL, 1997).

Risk assessments were conducted in 1995 to assess potential risks to human health and ecological receptors associated with exposure to Site 1 soil. Supplemental investigations were implemented in 2001 and 2004 to collect additional soil data necessary to adequately assess potential risks to human health and the environment and to revise the original human health and ecological risk assessments for Site 1 soil, and to comply with current regulatory guidance and protocol. Subsequently, in 2006, a focused Remedial Investigation was conducted to evaluate the nature and extent of the soil contamination present at Site 1 and the potential risks that soil contamination may pose to human and ecological receptors under residential and industrial scenarios (CH2M HILL, 2006a). In 2007–2008, debris characterization was conducted to characterize and further define the nature and extent of subsurface debris within the OABG (CH2M HILL, 2008a and 2008b). This work also included a digital geophysical mapping survey and global positioning unit survey. In 2012, the Navy, in partnership with West Virginia Department of the Environmental Protection and U.S. Environmental Protection Agency, developed the site remediation goals and evaluated soils contamination across the ABG and OABG through comparing the 95 percent upper confidence limit of sitewide soil concentrations against the SRGs. The outcome of this evaluation resulted in identification of areas targeted for remediation, hereinafter referred to as areas of concern (AOCs). The boundaries of the AOCs were assumed for development and comparison of remedial alternatives within the FS based on existing data for the site.

Following are the site-specific RAOs developed for Site 1 soil on the basis of the results of previous investigations and risk assessments:

- Prevent or minimize direct contact with soil constituents of concern (COCs) at concentrations above background that pose unacceptable risks to potential industrial workers, trespasser/visitor adolescents, construction workers, residents, and ecological receptors
- Prevent or minimize overland migration of COCs at concentrations above background to the North Branch Potomac River
- Prevent or minimize migration of COCs at concentrations above background from soil to groundwater, in order to enhance the ability of the groundwater remedy to restore the aquifers to beneficial use

- Render area free of surficial debris (including partially exposed debris) from within the boundaries of the OABG
- Control erosion and riverbank scour to prevent subsurface debris from becoming exposed

The potential future scenarios for hypothetical residential receptors were evaluated in the Remedial Investigation but are not included in the remedial alternatives because the reasonably anticipated future land use for the site is anticipated to be industrial, an active RCRA unit in the ABG, and the presence of a floodplain and extensive subsurface debris in the OABG. Land-use restrictions will be addressed as part of the land use controls (LUCs) within each remedial alternative. LUCs will be implemented to prevent unrestricted land use within the LUC area, which is estimated to be the area contained within the Site 1 boundary.

The initial phase of remedial alternative evaluation was to identify the general response actions that were capable of achieving the RAOs. A preliminary list of technically feasible remedial technologies and process options was then developed based on the identified general response actions. These technologies and process options were further screened according to cost, effectiveness, and implementability. The retained technologies were then assembled into remedial alternatives. The information presented in this FS report will be used by the Navy and regulatory agencies, with public involvement, to select a remedy for the site that complies with requirements set forth by the National Oil and Hazardous Substances Contingency Plan (NCP).

The following remedial alternatives were identified for the ABG soil:

- **Alternative 1—No Action**: This alternative is required by NCP as a baseline. Alternative 1 involves no action for the ABG.
- **Alternative 2 – Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt:** This alternative involves excavation of the areas comprising AOCs 1 through 6 within the ABG, backfill to original grade, offsite disposal, LUCs, and long-term management (LTMgt). In addition, residual contamination left in place after the non-time-critical removal action of Former Disposal Pit 1 and Former Disposal Pit 3 will be managed in the same manner as the AOCs (excavation, backfill, offsite disposal, LUCs and LTMgt).

The following remedial alternatives were identified for the OABG soil:

- **Alternative 1—No Action**: This alternative is required by NCP as a baseline. Alternative 1 involves no action for the OABG.
- **Alternative 2—Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt**: This alternative involves removal of surficial debris, excavation of the areas comprising AOCs 1 through 11 within the OABG as determined by the 95 percent UCL industrial scenario, anomaly avoidance, debris handling and management, reconfiguration of the Western Drainage Ditch, offsite disposal, sustainable bank restoration, LUCs, and LTMgt.
- **Alternative 3 – Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt:** This alternative comprises the same components as Alternative 2, with an additional component of treatment via *ex situ* thermal desorption of waste soil deemed hazardous to levels deemed non-hazardous before offsite disposal.

The alternatives were evaluated against the nine criteria defined in the NCP (Title 40 Code of Federal Regulations Part 300). The criteria permit comparison of the relative performance of the alternatives and provide a means to identify their advantages and disadvantages. The alternatives were also quantitatively evaluated in terms of sustainability (Navy, 2009).

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Acronyms and Abbreviations

ABG	Active Burning Ground
ABL	Allegany Ballistics Laboratory
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action, Navy
COCs	constituents of concern
CS	confirmation study
DNAPL	dense non-aqueous phase liquid
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ESS	Explosive Safety Submission
FDP	former disposal pit
FLUTe™	Flexible Liner Underground Technologies, LLC
FS	Feasibility Study
GHG	greenhouse gas
HHRA	human health risk assessment
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAS	Initial Assessment Study
IRP	Installation Restoration Program
LTM	long-term monitoring
LTMgt	long-term management
LUC	land use control
mg/kg	milligrams per kilogram
MIP	membrane interface probe
MPPEH	material potentially presenting an explosive hazard
NACIP	Navy Assessment and Control of Installation Pollutants Program
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Contingency Plan
NOSSA	Naval Ordnance Safety and Security Activity
NPL	National Priorities List
NTCRA	non-time critical removal action
OABG	Outside Active Burning Ground
O&M	operation and maintenance
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act

RD	remedial design
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SRG	site remediation goal
SSL	soil screening level
SVOC	semivolatile organic compound
T&D	transportation and disposal
TBC	to-be-considered
TCA	trichloroethane
TCE	trichloroethene
TEQ	toxicity equivalents
UCL	upper confidence limit
UXO	unexploded ordnance
VOC	volatile organic compound
WVDEP	West Virginia Department of Environmental Protection
yd^3	cubic yards

SECTION 1
Introduction

This Feasibility Study (FS) report was prepared by CH2M HILL under the Department of the Navy (Navy), Naval Facilities Engineering Command, Mid-Atlantic Division, Comprehensive Long-term Environmental Action, Navy (CLEAN) 1000 Contract 62470-08-D-1000, Contract Task Order WE13 for soils at Site 1, Operable Unit (OU) 4, at the Allegany Ballistics Laboratory (ABL), in Rocket Center, West Virginia. The activities described herein are part of the overall Installation Restoration Program (IRP) for ABL being implemented by the Department of the Navy (Navy), with regulatory oversight by the U.S. Environmental Protection Agency (EPA), and the West Virginia Department of the Environmental Protection (WVDEP). Since Site 1's inception in 1983, several environmental investigations have been conducted there. Because of its complexity, Site 1 has been investigated as two OUs: OU-3 for groundwater, surface water, and sediment and OU-4 for soil. A Record of Decision (ROD) was signed in May 1997 for OU-3 (Navy, 1997). The focus of this FS report is Site 1 soil (OU-4) and it was been developed in accordance with the Navy's IRP, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance (EPA, 1988), the National Oil and Hazardous Substance Pollution Contingency Plan (NCP; Title 40 Code of Federal Regulations [CFR] Part 300 et seq.), and other relevant EPA guidance.

1.1 Objectives

Previous investigation data and the current understanding of the site conceptual model formulated the basis for developing and comparing cost-effective remedial alternatives to address soil contamination at Site 1. The remedial alternatives address remedial action objectives (RAOs) and risk associated with Site 1 soil. This FS report includes a site-specific explanation of how each alternative satisfies the NCP selection criteria. It also documents the analyses and evaluations used to develop each remedial alternative. The information presented herein will be used by the Navy and regulatory agencies, with public involvement, to select the final remedy at Site 1 that complies with the requirements of the NCP. Following completion of the FS, a preferred alternative that best satisfies the RAOs will be presented in a Proposed Plan and will be submitted for public review and comment. The resulting comments will be reviewed, and a remedy will be selected and formally documented in an ROD.

1.2 Report Organization

This FS report is composed of the following sections:

- Section 1—Introduction
- Section 2 – Background Information
- Section 3—Remedial Action Objectives, Applicable or Relevant and Appropriate Requirements, Site Remediation Goals, and Areas of Concern
- Section 4—Screening of Remedial Technologies and Development of Remedial Alternatives
- Section 5—Descriptions and Detailed Analysis of Remedial Alternatives
- Section 6—Summary and Conclusions
- Section 7—References

Figures and tables referenced within the text are provided at the end of each section. Appendices are provided at the end of the report.

SECTION 2
Background Information

2.1 Facility Location and History

ABL is in Mineral County, in the northeastern part of West Virginia, approximately 10 miles southwest of Cumberland, Maryland, along the West Virginia and Maryland border. The facility lies between the North Branch Potomac River to the north and west and Knobly Mountain to the south and east. Several small towns are near the facility, including Short Gap, West Virginia, to the southeast, and Pinto, Maryland, to the north (Figure 2-1). The land surrounding the ABL facility contains primarily rural residences, agricultural lands, and forest. Several residences along US Route 220 in Maryland, ½ mile west of the facility in Maryland, obtain potable water from private wells. Approximately three residences north of ABL across the North Branch Potomac River and several residences south of ABL in West Virginia also obtain water from private wells. The latter are separated from the facility by mountains.

ABL consists of approximately 1,634 acres of land and about 350 buildings. The facility is divided into two distinct operating plants, Plant 1 and Plant 2 (Figure 2-1). Plant 1 is a government-owned, contractor-operated research, development, and production facility. It is owned by the Navy and leased to its operator, ATK Tactical Systems Company LLC, by the Naval Sea Systems Command through a Facilities Use Contract. Plant 1, approximately 1,577 acres in area, is divided into developed and undeveloped areas. Plant 2, exclusively owned and operated by ATK Tactical Systems Company LLC, occupies the remaining 57 acres. In June 1993, EPA proposed the Plant 1 portion of the ABL facility for inclusion on the National Priorities List (NPL), based on its estimated potential risks to human health and the environment. The Plant 1 portion of ABL was added to the NPL in the *Federal Register*, Volume 59, Number 27989, on May 31, 1994. Plant 2 is not on the NPL and is not discussed further in this document.

Since 1943, the ABL facility has been used primarily for research, development, testing, and production of solid propellants and motors for ammunition, rockets, and armaments. The manufacturing of solid propellant rocket motors can be summarized for purpose of this report into three basic steps: (1) production of rocket casings, (2) mixing explosives (for example, nitroglycerin and nitrocellulose) to generate the solid propellant, and (3) filling the rocket casings with the solid propellant. During this process, the four general waste types generated are spent solvents, reactive or ordnance materials, inert or non-ordnance materials, and solid waste.

Solvents are used at ABL to degrease cases, mix propellants, clean mixing bowls used for making propellant, and to clean molds and tools used in the overall process. Historically, the primary solvents used at ABL were acetone, methylene chloride, trichloroethene (TCE), and 1,1,1-trichloroethane (1,1,1-TCA). Each of these solvents has been used to varying degrees over the years. Acetone was the primary solvent used from 1942 until 1959. Although acetone was used after 1959 and is still used today, TCE was the primary solvent from 1959 through the late 1970s. Reportedly, the use of TCE was reduced in the 1980s and with that reduction the use of 1,1,1-TCA increased. Use of methylene chloride began in the late 1960s. Methylene chloride, TCE, and 1,1,1-TCA are no longer used. Currently, acetone, pentane, and kerosene are the primary solvents used.

Reactive or ordnance waste generated at ABL is waste material that, because of its composition, may burn violently or detonate. Typically, reactive wastes are excess or unused solid rocket propellants. Inert or non-ordnance wastes are ignitable solid wastes, which may be contaminated with reactive materials. The inert wastes are generated in areas where reactive propellant components are handled and, therefore, may or may not be contaminated with reactive wastes. However, because the inert wastes may be contaminated with reactive wastes, they are separated from ordinary solid waste and are burned in a manner similar to reactive ordnance waste. The ordinary solid wastes are deemed not contaminated with reactive materials, and may include trash, demolition debris, rocket casings, empty drums that once contained solvents, machinery waste, fiberglass, and other resin-coated fibers.

2.2 Background and Site Description

Site 1 is an 11-acre area situated adjacent to the North Branch Potomac River along the northern border of the developed portion of Plant 1 at ABL. Since the early 1940s, Site 1 has been used for various types of waste-burning and disposal activities. Based on current and historical site activities Site 1 has been divided in two geographical divisions (Figure 2-2):

- Active Burning Ground (ABG) – The ABG consists of several historical disposal units within an 8-acre fenced parcel, including three former disposal pits (FDPs) where disposal of spent acid and solvents occurred. The ABG is currently used for burning reactive wastes (as defined above) operating under a Resource Conservation and Recovery Act (RCRA) permit (permit number WV0170023691).
- Outside Active Burning Ground (OABG) – The OABG consists of a 3-acre parcel outside of the fenced area that was historically used for various waste disposal activities that occurred from the early 1960s until approximately 1981. During this time period, the activities consisted of disposing of demolition debris, drums, and rocket casings; as well as burning waste and spreading ash. The OABG is no longer in use and the area is not included within the boundaries of the active RCRA permit.

Below is a summary of each of these areas, and each is discussed in more detail in the Site 1 Focused Remedial Investigation (RI) report (CH2M HILL, 2006a).

2.2.1 Active Burning Ground

The ABG consists of several historical disposal units within an 8-acre parcel currently used for burning reactive wastes and is regulated under a RCRA permit. An 8-foot-tall locked fence surrounds the area, which is mostly covered by mowed grass. An asphalt road spans the east-west length of the fenced area. Although the ABG is operating under a RCRA permit, it was agreed by the Navy and regulatory agencies in April 2009 that this area potentially includes contamination attributed to historical waste burning; therefore, the ABG will be considered for remedial action under CERCLA. A RCRA Part B permit (permit number WVO170023691) and treatment plant air emissions RCRA Subpart X permit are in place for the continued operation of the ABG.

Burning reactive material at the ABG began in 1959 and continues today. Eight earthen burn pads, operated from 1959 until the mid-1990s, were used to burn solvents and explosive waste generated at ABL. These pads were numbered 1 through 8, going from east to west (Figure 2-2). Pad 1 was a bunker for explosive wastes, and Pad 2 handled reactive wastes generated from the chemistry laboratory. Solid propellants were handled at Pads 3 and 4, and reactive solvents (for example, acetone contaminated with explosives, nitrate esters, nitroglycerin, and glycerin triacetate) were burned at Pads 5 through 8. Reactive solvents were typically absorbed into sawdust before burning (CH2M HILL, 1996). The former earthen burn pads are not currently used and have been overgrown by vegetation. Six steel burn pans, which were located on earthen or asphalt burning pads, replaced the eight former earthen burn pads (Figure 2-2). These have since been replaced by six large concrete burn pads, labeled Pad A through Pad F, going from east to west.

Historical disposal of spent acids and solvents generated by plant operations occurred in three pits (FDP 1, FDP 2, and FDP 3) constructed as unlined crushed-limestone-filled earthen pits. After the materials percolated into the ground, it was reported that the pits were ignited to burn off remaining filtrate. The pits were operated during the 1970s and 1980s and have since been backfilled. Reportedly, TCE was the primary spent solvent that was disposed in the pits, which are known to be a source of contamination to groundwater (CH2M HILL, 1996). TCE has been detected at elevated concentrations in the unsaturated soil beneath FDPs 1 and 3. FDP 2 does not contain detectable chlorinated solvents and is not considered a source of contamination to groundwater. The size and location of the FDPs are based upon historical boundaries using visual observation of ground scarring, as well as a geophysical investigation of the pit areas (Roy F. Weston, 1987). The pits are located in the southwestern portion of the ABG and are described as being approximately 10 feet wide and ranging in length from approximately 15 to 40 feet (Figure 2-2). The depths of the pits were estimated at 3 to 5 feet below ground surface (bgs). A non-time critical removal action (NTCRA) has been initiated (AGVIQ-CH2MHILL, 2013a) to address potential sources of groundwater contamination in the unsaturated soil at FDPs 1 and 3 in accordance with the Engineering Evaluation and Cost Analysis (EE/CA) and Action Memorandum (CH2M HILL, 2012a and 2012b).

2.2.2 Outside Active Burning Ground

The OABG was historically used for various waste disposal activities. Based on historical activities, the OABG has been divided into the following areas, as shown on Figure 2-2:

- West OABG - The West OABG, also known as the Former Open Burn Area and Associated Disposal Area, is along the river in the northwest part of Site 1. It consists of the former open burn area, former drum storage pad, and western drainage ditch. The former open burn area, reportedly operated during the 1960s, was enclosed behind a chain link fence where the solid wastes were burned. The resulting ash was spread along the lower floodplain area in a portion of the West OABG. The drum storage pad, reportedly operated from 1979 to 1981, stored 55-gallon drums containing spent solvents and bottom sludge from solvent recovery stills. The asphalt drum storage pad did not have berms or sumps for containment. The asphalt pad is still present although it is not currently used to store drums. The western drainage ditch is an earthen drainage culvert that cuts through the disposal area and drains surface/stormwater from Plant 1. Debris materials, including ash buried during successive disposal events, are exposed in the walls of this culvert. Surface and subsurface debris is present throughout the West OABG. The area is currently covered by vegetation.
- East OABG – The East OABG, also known as the Former Inert Burn Area and associated disposal area, is along the river in the northeastern portion of the site. Ash from burning in this area was spread and buried during successive disposal events. Surface and subsurface debris are present throughout the East OABG. The area is currently covered by vegetation.
- Central OABG – The Central OABG lies along the river between the West OABG and East OABG. This area showed no evidence of debris or disposal activities through visual observation or subsurface soil sampling.

2.3 Site Characteristics

This section summarizes the geologic and hydrogeologic characteristics of Site 1. Detailed discussions on these subjects are presented in the focused RI report (CH2M HILL, 2006a).

2.3.1 Geology and Hydrogeology

The Site 1 geology and hydrogeology have been characterized during previous investigations, through literature research, and by a number of project-specific field activities. The field activities have consisted of drilling, soil sampling, rock coring, geophysical logging, downhole video recording, seismic refraction, seismic reflection, fracture trace analysis, water-level measurements, and aquifer testing. The Site 1 geology and hydrogeology are briefly summarized herein; detailed descriptions are presented in the following reports:

- *Remedial Investigation of the Allegany Ballistics Laboratory* (CH2M HILL, 1996)
- *Focused Remedial Investigation of Site 1 at Allegany Ballistics Laboratory Superfund Site* (CH2M HILL, 1995a)
- *Final Phase I Aquifer Testing at Allegany Ballistics Laboratory Superfund Site* (CH2M HILL, 1998a)
- *Final Phase II Aquifer Testing at Site 1 at Allegany Ballistics Laboratory Superfund Site* (CH2M HILL, 1999)

Generally, Site 1 is underlain by two distinct lithologies: (1) unconsolidated alluvial deposits of clay, silt, sand, and gravel; and (2) predominantly shale bedrock. Drilling efforts at Site 1 indicated that the unconsolidated alluvial deposits overlying bedrock generally consist of two distinct layers of material. The upper, or surficial, layer of alluvium consists of silty clay and is considered floodplain deposits of the North Branch Potomac River. At Site 1, this upper alluvial layer extends from the ground surface to an average depth of approximately 12 feet bgs. The lower layer of the alluvium consists of a sand and gravel layer containing pebbles and cobbles with variable but typically significant amounts of clay and silt, and is considered to be alluvial deposits of the North Branch Potomac River. At Site 1, this lower alluvial layer has an average thickness of approximately 14.5 feet. Below the alluvium lies bedrock consisting of mainly calcareous shale and limestone of Silurian age. The average depth to bedrock at Site 1 is approximately 26.5 feet bgs.

Water-level measurements taken in alluvial monitoring wells indicate the average depth to groundwater in the vicinity of the FDPs is 10 to 12 feet bgs, corresponding to the upper alluvium layer. Therefore, the sand and gravel alluvium constitutes the shallow, unconsolidated aquifer at the site. Recharge to this aquifer is believed to be derived primarily from infiltration of precipitation that falls on Plant 1. Depth to groundwater in the bedrock aquifer is approximately 20 feet bgs. As discussed in the previous reports, there is a high degree of interconnectivity between the alluvial and bedrock aquifer. Within the alluvial and bedrock aquifers, natural groundwater flow is toward the North Branch Potomac River, which is believed to be its ultimate discharge point. However, since the beginning of the Site 1 groundwater remediation, groundwater under most of Site 1 is captured for treatment and does not reach the river.

Cross sections were developed for Site 1 using information from previous investigations, including monitoring well and extraction well installation, groundwater measurements, and test pits conducted during the debris characterization. Figure 2-3 shows a plan view of two cross sectional areas (A-A', B-B', C-C', and D-D') at Site 1, and Figure 2-4, Figure 2-5, and Figure 2-6 show cross sections of the underlying geology of Site 1 at these locations.

2.4 Previous Investigations

Several investigations and evaluations have been conducted at Site 1. Below is a chronological description of each. Soil sample locations for the ABG and OABG are shown on Figures 2-7 and 2-8, respectively.

2.4.1 Initial Assessment Study (1983)

An Initial Assessment Study (IAS) was performed at ABL in 1983 under the Navy Assessment and Control of Installation Pollutants Program (NACIP). The purpose of the IAS was to identify and assess sites that might pose a threat to human health or the environment as a result of the former hazardous materials handling and operations (Environmental Science and Engineering, Inc., 1983). Nine potentially contaminated sites, including Site 1, were identified based on information obtained from historical records, photographs, site inspections, and personnel interviews. The IAS concluded that these sites did not pose an immediate threat. However, results of the IAS indicated the need for a confirmation study (CS) at seven of the nine sites, including Site 1, to assess the potential impacts on human health and the environment by suspected contaminants.

2.4.2 Confirmation Study (1987)

Based on the IAS recommendations and in accordance with the NACIP, a CS was initiated in June 1984 and completed in August 1987. The CS focused on identifying the existence, concentration, and extent of contamination at the seven sites recommended for further investigation in the IAS. Field activities conducted under the CS included monitoring well installation; groundwater, surface water, sediment, and soil gas sample collection and analysis; and a geophysical survey inside the ABG area at Site 1.

2.4.3 Interim Remedial Investigation (1989)

As a result of the Superfund Amendments and Reauthorization Act of 1986 (SARA), the Navy changed its NACIP terminology and scope under the IRP to follow the rules, regulations, guidelines, and criteria established by EPA for the Superfund program. Accordingly, the results of the CS were documented in the Interim RI report (Roy F. Weston, 1989), which recommended further RI activities for six of the seven sites identified in the IAS, including Site 1.

2.4.4 Remedial Investigation (1996)

Based on the recommendations of the Interim RI report and in accordance with the Navy's modified IRP policy, Hercules (former ABL operator) contracted CH2M HILL to conduct an RI (CH2M HILL, 1996). Field work was completed in 1992; however, the RI report was not finalized until 1996. The RI followed EPA's RI/FS format under CERCLA, as described in *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA, 1988).

During the RI, historical aerial photographs were reviewed to identify the type and location of potential waste disposal activities at Site 1 and other sites. A focused facility audit was also conducted to identify possible sources of contamination. A variety of analytical methods and techniques were employed during the RI. Field activities consisted of installation of monitoring wells, soil sampling, groundwater sampling, surface water and sediment sampling, well testing, a fracture-orientation investigation, and water level measurements.

The results of the 1992 RI are presented in the *Remedial Investigation of the Allegany Ballistics Laboratory* report (CH2M HILL, 1996). Volatile organic compounds (VOCs), particularly TCE, were the primary constituents detected in soil, groundwater (in both alluvial and bedrock aquifers), surface water, and sediment samples collected at and adjacent to Site 1. The three FDPs were found to be the primary source of VOC contamination at Site 1. Semivolatile organic compounds (SVOCs), explosives, metals, and dioxins also were detected in soil and ash samples. The 1996 RI report recommended additional investigation at Site 1 to further evaluate the nature and extent of contamination in soil, groundwater, surface water, and sediment.

2.4.5 Focused Remedial Investigation (1995)

A focused RI was conducted in 1994 to supplement the Site 1 data collected in 1992 for the 1996 RI and to re-evaluate potential risks to human health and the environment from contaminants in Site 1 media. The results are presented in the *Focused Remedial Investigation of Site 1 at Allegany Ballistics Laboratory Superfund Site* report (CH2M HILL, 1995a). The results of the focused RI confirmed that VOCs were the primary contaminants detected in Site 1 media, with TCE detected most often and at the greatest concentrations in soil and groundwater.

The focused RI identified specific areas and media at Site 1 where remedial action alternatives should be evaluated in a focused FS. These were the areas of contaminated soil around the FDPs, north of the east and west ends of the ABG area along the river, and in the open and former inert burn disposal areas; contaminated groundwater in both alluvial and bedrock aquifers; and contaminated surface water and sediment in the North Branch Potomac River adjacent to Site 1.

2.4.6 Focused Feasibility Study (1995)

A focused FS was conducted in 1995 to evaluate remedial alternatives to address risks associated with contamination detected at Site 1. The draft report summarized the focused RI and that information was used as a basis for developing and evaluating cost-effective remedial alternatives to address contamination at Site 1. The study developed seven remedial alternatives to address both soil and groundwater contamination across the site, which are documented in the *Draft Site 1 Focused Feasibility Study at Allegany Ballistics Laboratory Superfund Site* report (CH2M HILL, 1995b). The document was never finalized.

2.4.7 Soil Level Delineation (1998)

Based on soil data gathered during the focused RI and previous investigations, supplemental soil sampling was conducted in October 1998 to further delineate potentially contaminated areas at Site 1. The soil level delineation was conducted in accordance with the *Site 1 Soil Level Delineation – Final* memorandum (CH2M HILL, 1998b), which defined the scope and rationale for sample collection and referenced the *Sampling and Analysis Plan for the Focused Remedial Investigation/Feasibility Study for Site 1 at the Allegany Ballistics Laboratory Superfund Site* (CH2M HILL, 1994) as the methodology protocol. A formal report of the supplemental soil sampling was not generated; however, these and other historical data were evaluated to assess whether sufficient information existed to establish preliminary remediation goals (PRGs) for Site 1 soil. This evaluation resulted in the identification of additional data requirements and the need to refine the human health and ecological risk assessments in accordance with current regulatory guidance.

2.4.8 Soils Supplemental Investigations (2004)

The results of the 1992 RI, 1994 focused RI, 1995 focused FS, and the 1998 soil level delineation indicated that additional data needed to be collected to adequately delineate the nature and extent of soil contamination at Site 1 and to assess the associated potential risks. Details regarding the supplemental investigations can be found in *Draft Ecological Risk Assessment for the Burning Grounds at Allegany Ballistics Laboratory* (CH2M HILL, 2002) and the *Final Work Plan Addendum for Supplemental Investigation of Site 1 Soil in Support of Human Health and Ecological Risk Assessment, Allegany Ballistics Laboratory, Rocket Center, West Virginia* (CH2M HILL, 2004a).

In February and October 2001, a soil investigation was conducted to assess current conditions of soil within the ABG to support its continuing operation. The objectives of collecting the data were to assess potential risk to human health and the environment resulting from operation of the ABG, develop the ABG RCRA closure plan, assist in defining operational-related monitoring, provide input to pan/pad redesign activities, and to provide the baseline for an assessment of compliance with the permits. In addition, based on a review of existing soil data, including the proximity of areas of potential soil contamination to the North Branch Potomac River, collection of additional data was deemed necessary, primarily to assess whether soil constituents in areas of suspected contamination were affecting the surface water and sediment quality of the river via runoff.

In July 2004, soil and tissue sampling (earthworms) was conducted to support Step 4 of the baseline ecological risk assessment (ERA). In September 2004, a supplemental investigation of the soil at Site 1 in support of both the human health and ecological risk assessments was conducted to obtain additional nature and extent data and adequately assess potential human and ecological risks for Site 1 soil.

2.4.9 Soils Focused Remedial Investigation (2006)

In 2006, a second focused RI was completed for Site 1 to evaluate the nature and extent of the soil contamination at the site and the potential risks that soil contamination may pose to human receptors under residential and industrial scenarios and to ecological receptors (CH2M HILL, 2006a). The discussions and assessment were based on data collected as part of the 2001 and 2004 supplemental investigations, as well as data from previous investigations.

The 2006 focused RI identified potential unacceptable risks to human health and the environment based on exposure to OABG soil and debris. Based on the results of the risk assessments, it was recommended that an FS be prepared to evaluate the remedial alternatives proposed to address the potential risks identified for soil within the FDPs and the OABG areas at Site 1. Because active burn operations were in progress operating under a RCRA permit, the Navy, in partnership with WVDEP and EPA, agreed the ABG, excluding the FDPs, would not be included in the CERCLA action at this time.[1]

2.4.10 Wetland Assessment (2006)

A field review of Site 1 was conducted in order to determine whether wetlands or water bodies are present within the area (CH2M HILL, 2006b). No wetlands were identified within the Site 1 study area, which consists of the ABG and OABG. The North Branch Potomac River, which borders Site 1 to the north, was mapped as a permanent, lower perennial, unconsolidated bottom, slow moving river. Another wetland area was identified to the east of Site 1, but was outside of the study area. This small wetland was mapped as a seasonally flooded, broad-leaved deciduous, forested wetland.

2.4.11 OABG Geophysical and Global Positioning System Survey (2008)

Geophysical and global positioning system surveys were performed in May 2007 in support of the debris characterization to assist in the selection of the test pit locations. Survey results showed that the western and eastern regions of the OABG demonstrated the highest response to the geophysical instrumentation, indicating the location of metallic debris on the surface or in the subsurface within those areas. In contrast, the central region of the site showed little to no response. Detailed description of both surveys can be found in the final Work Plan (CH2M HILL, 2008a).

[1] Although the ABG is operating under a RCRA permit, it was agreed by the Navy and regulatory agencies in April 2009 that this area includes contamination attributed to historical waste burning; therefore these portions of the ABG will be considered for remedial action under the Comprehensive Environmental Response, Compensation, and Liability Act. The OABG consists of a 3-acre parcel outside of the fenced area that was historically used for various waste disposal activities that no longer occur. The OABG is not included in the active burning activities or the RCRA permit. The remedial alternatives for both the OABG and ABG, which are developed and evaluated within the FS and selected within the Proposed Remedial Action Plan and Record of Decision, will be the final action under the Comprehensive Environmental Response, Compensation, and Liability Act. However, for the ABG, the selected remedial alternative is not intended to be the final action under RCRA. The RCRA closure requirements, as outlined in the RCRA Subpart X permit, will be met upon closure of the RCRA unit.

2.4.12 OABG Limited Surface Debris Removal (2008)

In February and March 2008, Shaw Environmental, Inc. conducted a limited surface debris removal in preparation for the debris characterization (Shaw Environmental, Inc., 2008). Work was conducted under an approved Explosive Safety Submission (ESS) waiver and included unexploded ordnance (UXO) avoidance. Small shrubs and trees were cleared, and surface piles of construction and manufacturing debris were removed from the OABG areas where test pitting was to take place. Surface debris removed from the site was contained in portable roll-off boxes and sent offsite for proper disposal, with the exception of rocket casings containing asbestos material, which were removed and disposed by a licensed asbestos abatement contractor.

Currently, surface debris (surficial and partially buried) remains throughout the OABG, Western Drainage Ditch, and bank of the North Branch Potomac River. This debris includes piles of construction and manufacturing debris, some of which is intertwined with vegetation along the river bank. Furthermore, asbestos-containing ballistic rocket casings are present at the surface within the OABG.

2.4.13 OABG Debris Characterization (2008)

Following the limited surface debris removal, debris characterization was conducted in March and April 2008 (CH2M HILL, 2008b). Work was conducted under an approved ESS waiver and included UXO avoidance. Debris characterization was conducted to further define the nature and extent of subsurface debris within the West OABG, Central OABG, and East OABG. The objectives of the debris characterization were to further define the vertical and horizontal extent of debris within the OABG, identify the general composition of debris and foreign material present on the surface and in the subsurface soil, and determine if the debris and foreign material in the subsurface had contaminated the underlying soil.

Forty-nine exploratory test pits were excavated to a depth of 10 feet or until groundwater was encountered and then backfilled. Each test pit location was chosen based on information obtained during the geophysical survey, review of historical aerial photographs, and field observations such as irregular topography and exposed debris. In locations where potential asbestos-containing materials were observed, such as rocket casings or various construction materials, the test pit was either shifted to avoid disturbance or discontinued.

The bulk of the surface and subsurface debris was shown to be buried in the West and East areas of the OABG; the Central area showed no surface or subsurface debris based on visual observations and test pits completed in this area. Twenty-seven test pits were excavated in the West OABG and indicated the presence of burn debris, construction debris, and manufacturing debris, as described below. The presence of burn debris within the area was more common around the Former Open Burn Area (Figure 2-2). Eight test pits were excavated in the Central OABG and indicated the presence of only native soil. Fourteen test pits were excavated in the East OABG and indicated the presence of burn debris, construction debris, and manufacturing debris, as described below. The presence of burn debris within the area was focused around the approximate Former Inert Burn Area (Figure 2-2). Figure 2-9, Figure 2-10, and Figure 2-11 provide estimations of the vertical and horizontal extent of surface and subsurface debris (delineated using contours), as well as the type of debris encountered at each test pit location (identified by color-coded test pits).

Subsurface debris in the West OABG (Figure 2-9) is estimated to be buried as deep as 12 feet bgs along the riverfront and to depths as shallow as 3 feet bgs in areas south of the OABG fence line. This 12-foot depth was determined by visual observation of debris along the river embankment and surface contours that show the drop in elevation to the river elevation. The Central OABG (Figure 2-10) contained no surface or subsurface debris, based on the visual observations and test pits completed in this region. Subsurface debris in the East OABG (Figure 2-11) is estimated to be buried to an average depth of 9 feet bgs, with some locations buried as deep as 12 feet bgs and some as shallow as 6 feet bgs. Although test pits were excavated to a depth of 10 feet bgs, visual evidence in the bottom of test pits TP-30, TP-37, and TP-38 in the East OABG showed that debris extends beyond this depth and possibly to a depth of 12 feet bgs. In addition to the debris characterization, aerial photographs of ABL from 1962 and 1972 were analyzed to determine the extent of debris inside the fence line at Site 1. The photographs indicated that debris may be present up to 150 feet south of the West OABG fence line and up to 100 feet east of the Site 1 boundary.

Based on the composition of the material observed in the test pits during the 2008 OABG debris characterization, the subsurface debris was characterized as follows:

- Burn Debris/Ash – Fill material with contents that appears to be associated with burning disposal activities such as ash, glass, and other partially burned materials.
- Construction Debris – Fill material that appears to be associated with construction activities such as concrete, rubble, rebar, wood, tires, cables, and other metallic objects.
- Manufacturing Debris – Fill material that appears to be associated with production and manufacturing activities at the facility such as rocket boosters, casings, ventures, thrust vectors, 55-gallon drums, motors, tanks, and piping.
- Native Soil – Material that appears to be undisturbed or visually free of contamination or unnatural debris.

In addition to the debris characterization, samples were collected from 38 test pit locations. Each was analyzed for VOCs, SVOCs, and metals. A portion was analyzed for dioxins and explosives. The results indicated that the detected constituents in the subsurface soil matched the constituents of concern (COCs) presented in the 2006 focused RI. In general, there does not appear to be an association between elevated detections of TCE, the primary risk driver, and presence of subsurface debris in the West OABG. The highest concentrations of TCE were associated with test pits containing burn debris/ash (TP-05), manufacturing debris (TP-14), and native soil (TP-13 and TP-15). In addition, there were seven test pits in the West OABG that did not have detections of TCE. These test pits were associated with burn debris ash (TP-04), construction debris (TP-07 and TP-08), and native soil (TP-01, TP-02, TP-03, and TP-31). In general, there appears to be an association between elevated detections of TCE, the primary risk driver, and presence of subsurface debris in the East OABG. The highest concentrations of TCE were associated with the test pits containing burn debris/ash (TP-28, TP-29, and TP-36) and are likely associated with the former inert burn disposal area. TCE was detected in all test pits within the East OABG.

2.4.14 Membrane Interface Probe and FLUTe™ Liner Investigation (2010)

A membrane interface probe (MIP) and Flexible Liner Underground Technologies, LLC (FLUTe™) liner study was completed at the location of the FDPs at Site 1 between December 2009 and March 2010 (CH2M HILL, 2010). The objective of the investigation was to determine if dense non-aqueous phase liquid (DNAPL) was present in the unsaturated zone (ground surface to approximately 15 feet bgs). The MIP was conducted at 55 locations. Twenty-one of the 55 locations had an MIP response, indicating that further investigation with the FLUTe™ liners was warranted to confirm the presence or absence of DNAPL. The FLUTe™ liner investigation was conducted during a second mobilization to the site. Twenty-one FLUTe™ liners were emplaced in the vadose zone and shallow aquifer to a maximum depth of 13.5 feet bgs. None of the FLUTe™ liners indicated the presence of DNAPLs in the vadose zone.

2.4.15 Engineering Evaluation and Cost Analysis and Action Memorandum (2012)

An EE/CA was prepared to evaluate removal action alternatives to conduct an NTCRA of the unsaturated soil beneath FDPs 1 and 3 within the ABG, which are believed to be primary sources of contamination to groundwater (CH2M HILL, 2012a). The objective is to reduce the source present in the unsaturated soil beneath FDPs 1 and 3, in order to enhance the ability of the groundwater remedy to restore the aquifers to beneficial use.

An Action Memorandum was prepared to document the selection and approval of the NTCRA to address source area soil beneath FDPs 1 and 3 at Site 1 (CH2M HILL, 2012b). The preferred alternative consists of the excavation, removal, and disposal of the VOC source area in the unsaturated soils beneath FDPs 1 and 3. The excavation will then be replaced with clean fill and seeded to restore current site conditions.

The NTCRA is intended to supplement the final remedy for Site 1 soil and augment the existing groundwater treatment system by reducing the potential contaminant source mass and prevent future leaching to groundwater.

2.4.16 Investigation of Former Disposal Pit 1 (2013)

An investigation was completed at FDP 1 to supplement the ongoing post-ROD optimization efforts associated with the existing groundwater extraction and treatment system (AGVIQ/CH2M HILL, 2013b). The investigation was divided into two phases, Phase I was completed in January 2011 and Phase II was completed in April 2012. Phase I (Focused Extraction Optimization at FDP 1) consisted of employing the existing groundwater model for ABL to estimate the additional groundwater extraction flow rate required to enhance hydraulic capture of TCE contamination within the alluvial aquifer at the FDP 1 area. The results of Phase I are presented in the *Final Sampling and Analysis Plan, Site 1 Former Disposal Pit 1 Investigation* (AGVIQ-CH2M HILL, 2012) and were used as the basis for data collection efforts conducted in Phase II. Phase II consisted of the collection of soil and groundwater data from the FDP 1 alluvial aquifer to refine the conceptual site model and perform *in situ* chemical oxidation bench-scale testing. Investigation activities consisted of a subsurface soil investigation, hydraulic investigation, groundwater sampling, and *in situ* chemical oxidation bench-scale testing. The results of Phase II are presented in the *Draft Final Technical Memorandum for Site 1 – Former Disposal Pit Investigation Results Summary* (AGVIQ-CH2M HILL, 2013b).

2.4.17 Work Plan for Non-Time Critical Removal Action of FDP1 and FDP3 (2013)

A work plan was prepared to outline the implementation procedures to be used to conduct an NTCRA consisting of excavation and proper offsite disposal of potentially hazardous and non-hazardous soil associated with the FDP 1 and FDP 3 within the ABG (AGVIQ-CH2M HILL, 2013a). The work plan was developed in conjunction with the EE/CA (CH2M HILL, 2012a), Action Memorandum (CH2M HILL, 2012b), and investigation of FDP 1 (AGVIQ-CH2M HILL, 2013b). The tentative date for mobilization is September 2013.

2.5 Summary of Site Risk

A quantitative human health risk assessment (HHRA) and ERA were conducted during the focused RI for soil within the ABG and OABG (CH2M HILL, 2006a). In addition, an evaluation of the potential for constituents to leach from soil to groundwater at levels posing a potentially unacceptable risk was completed for Site 1 soils. Results have been documented in the *Revised Final Technical Memorandum Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1, Allegany Ballistics Laboratory Rocket Center, West Virginia* (CH2M HILL, 2013), which can be found in Appendix A. Data collected between 1992 and 2004 were included in the risk assessments and soil-to-groundwater evaluation.

The ABG, excluding the FDPs, was not included in the CERCLA action at the time of the focused RI, and the HHRA did not evaluate the potential future resident scenario for the ABG. It was agreed by the Navy and regulatory agencies in April 2009 that the ABG contains contamination attributed to historical waste burning; therefore the ABG was added to the Site 1 remedial action. In addition, the human health and ecological risks were re-evaluated based on the most current toxicity criteria dated November 2012. The update included the addition of perchlorate, an emerging contaminant that is in the process of being regulated under the Safe Drinking Water Act (EPA, 2012).

2.5.1 Human Health Risk Assessment

The baseline HHRA was conducted to evaluate the potential human health risks associated with surface soil and combined soil (surface and subsurface soil) at the ABG, FDPs (addressed separately from the ABG in the RI), and OABG. Potential risks were calculated for current/future industrial worker, adolescent trespasser/visitor, adult recreational person, and adolescent recreational person, as well as for future adult resident, child resident, lifetime resident, and construction worker.

COCs were selected as those chemicals contributing individual cancer risks above 10^{-6} to total cancer risks for a potential human receptor that were above 10^{-4}, or contributing individual non-carcinogenic hazards above 0.1 to total hazard indices for a potential receptor above 1.0. No unacceptable risks associated with exposure to surface soil were identified under the current exposure scenarios. The only unacceptable risk was associated with exposure to combined soil by future residents. A summary of site risks associated with each receptor scenario is provided in Table 2-1.

2.5.2 Ecological Risk Assessment

The baseline ERA was conducted to evaluate the potential ecological risks associated with surface soil at the ABG, FDPs, and OABG (CH2M HILL, 2006a). Because of their proximity and similarity in habitat, the ABG and FDP areas were addressed together and referred to as “upland habitat.” Because most of the OABG area is within the floodplain of the river, this area was referred to as “floodplain habitat.” The terrestrial portion of the ERA was quantitatively conducted using surface soil samples collected from the top foot of the soil column because this depth range represented the most realistic potential exposures for most of the ecological receptors evaluated in terrestrial habitats. Because some ecological receptors may be exposed, at least periodically, to deeper soils, available subsurface soil data from the 12- to 24-inch depth interval (a few samples that extended to 3 feet bgs were also used) were also qualitatively considered to find out if constituent concentrations in the subsurface layers were higher than in surface layers.

Potential risks were evaluated for lower-trophic-level receptors (terrestrial plants and soil invertebrates for direct exposures to surface soil) and for upper-trophic-level receptors (birds and mammals, for food web exposures). Laboratory toxicity tests (bioassays) were conducted using split samples of surface soil collected from floodplain areas of the site. Earthworms were the test organism and a total of 15 tests were conducted, two of which were from reference areas. Earthworm tissue samples from five of these samples (four site samples and one reference sample) were analyzed for dioxins/furans following completion of the toxicity tests.

Surface soil COCs were selected based on a comparison of site surface soil concentrations to literature-based soil screening values and site-specific background concentrations (CH2M HILL, 2006a), the results of soil toxicity testing, and the results of food web modeling. A summary of site risks associated with ecological receptor exposure is provided in Table 2-2.

For upland areas, potential unacceptable risks were associated with direct exposure to several metals and explosive compounds in surface soil. Baseline risk estimates using area-wide averages indicated low to negligible risks for upper-trophic-level receptors in upland habitats. The upland portion of Site 1 is covered with periodically mowed grasses and other herbaceous plants, providing habitat of limited diversity and quality. Except for unpaved roads and the areas immediately around some of the active burn pans, no obvious phytotoxic effects (for example, large areas of bare soil or dead or dying plants) were observed. Given the limited habitat quality of the ABG area, particularly in the vicinity of the active burn pads where most of the significant exceedances were found, concentrations of the metal and explosive COCs are not likely to result in adverse impacts to populations of ecological receptors.

For floodplain areas, potential unacceptable risks were associated with direct exposures to several metals, explosives, volatile organic compounds, and polycyclic aromatic hydrocarbons (PAHs) in surface soil. The highest concentrations of these constituents generally occurred in the vicinity of the Former Open Burn Area, the Western Drainage Ditch, and in the vicinity of the Former Inert Burn Area. Several of these samples consisted mostly of ash rather than soil. PAH concentrations were elevated in several samples clustered on or near the banks of the Western Drainage Ditch. At two of these locations, PAHs were identified as potentially responsible for soil invertebrate toxicity. TCE and 1,2-dichloroethene exceeded screening values in the vicinity of the Former Inert Burn Area. Mercury was the only constituent with an exceedance based on the lowest observed adverse effect level for terrestrial-based food web exposures in the OABG area. In addition to mercury, hazard quotients exceeded 1.0 based upon the maximum acceptable toxicant concentration for cadmium (short-tailed shrew), lead (American robin), zinc (American robin), and dioxin/furans (long-tailed weasel).

The results of the soil toxicity test were generally consistent with the results from the surface soil screening. The most impacted samples, which had a mean survival of less than 25 percent and little if any signs of reproduction, were associated with three locations in or near the Western Drainage Ditch, three locations within the Former Inert Burn Area, and one reference location collected west of Site 1 outside the site boundary.

2.5.3 Soil-to-Groundwater Leaching

Site-specific soil screening levels (SSLs) were developed to evaluate COC concentrations in soil that are protective of the uppermost groundwater-bearing unit. The approach used to develop the SSLs follows EPA's *Soil Screening Guidance* (EPA, 1996) and the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (EPA, 2002). The basis of the approach is that infiltrating precipitation leaches the contaminants from the soil and transports them into the aquifer, and the contaminants are then diluted by the lateral flow within the aquifer. The approach assumes that a hypothetical future groundwater user is present on the immediate downgradient boundary of the site. Potable groundwater use is assumed for the hypothetical future scenario for the Site 1 SSL evaluation. Additional details regarding the site-specific SSLs and the procedure for calculating the SSLs can be found in Appendix A. A summary of site risks associated with soil-to-groundwater leaching in the ABG and OABG is provided in Tables 2-3 and 2-4, respectively.

2.6 Site Remediation Goals

The SRGs for Site 1 soil were derived based on the lower of the human health and ecological risk-based PRGs, site-specific SSLs (as applicable), or facility-wide background concentration (as applicable). Background concentrations are presented in the *Final Technical Memorandum: Background Soil Investigation* (CH2M HILL, 2004b).

2.6.1 Preliminary Remediation Goals

PRGs were calculated for both human health and ecological exposure scenarios, for the COCs identified for ABG and OABG based on their respective risk assessments. As previously noted, human health COCs were identified for only the future residential scenario. However, PRGs were calculated for the human health COCs to ensure concentrations of COCs remaining onsite would be below levels to allow for industrial land use. These PRGs were also used in support of evaluating post-RI data in conjunction with future land use to establish the focus areas of remediation. Additional details can be found in the SRG technical memorandum in Appendix A. Supporting calculations for the human health and ecological risk-based PRGs are presented in Attachments A and B of Appendix A, respectively.

2.6.2 Site-specific Soil Screening Levels

Site-specific soil-to-groundwater leaching considerations presented as SSLs are model-generated values based on a number of assumptions, which include a uniform distribution of COCs across the entire site and no degradation (abiotic or biotic) of the chemicals during either vertical or horizontal transport through the vadose zone and the aquifer. Therefore, leachate concentrations may either be over or underestimated. In order to determine how to apply SSLs during SRG development, the Navy, in partnership with WVDEP and EPA, agreed that an evaluation of SSLs with respect to groundwater concentrations across the site is warranted.

Groundwater data collected since the signing of the ROD in 1997 as part of CERCLA long-term monitoring (LTM) and RCRA compliance monitoring were used to evaluate the applicability of the SSLs at Site 1. Because the groundwater data are collected from monitoring wells within the ABG, the data set was not applied to SSL determinations in the OABG. The lines of evidence considered in determining the applicability of the SSL for each COC consisted of evaluating whether the constituent is a COC in groundwater as defined in the ROD; the frequency of detections and exceedances of risk-based screening levels since the ROD, and whether exceedances of risk-based screening levels are localized to elevated constituent concentrations in soil. Additional details can be found in the SRG technical memorandum in Appendix A.

2.6.3 Site Remediation Goals

SRGs for the ABG COCs, which includes the FDPs, were identified for the industrial scenario. The potential future scenarios for hypothetical receptors (future residential receptors) were not included in the SRG determination because the reasonably anticipated future land use of Site 1 is industrial. The ABG is an active RCRA unit and the OABG consists of a floodplain and is underlain by extensive subsurface debris. The SRGs for both the ABG and OABG were selected based on a restricted land-use scenario for human health (industrial scenario) and an unrestricted land-use scenario for ecological receptors and groundwater protection. The OABG evaluation considered the entire area as a whole, with no separation between the West, Central, and East areas.

Considerations for ecological receptors were incorporated into each scenario. Tables 2-5 and 2-6 summarize the SRG selection process for the ABG and OABG, respectively. A detailed discussion of the SRG selection process can be found in the SRG technical memorandum in Appendix A.

Table 2-1
Summary of Human Health Risk Assessment
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Receptor	Media	Risk	Constituents of Concern
Current Industrial Worker	Surface Soil - Former Disposal Pits	Acceptable	None
	Surface Soil - Outside Active Burning Grounds	Acceptable	None
	Surface Soil - Active Burning Grounds	Acceptable	None
Current Trespasser/Visitor Adolescents	Surface Soil - Former Disposal Pits	Acceptable	None
	Surface Soil - Outside Active Burning Grounds	Acceptable	None
	Surface Soil - Active Burning Grounds	Acceptable	None
Future Industrial Worker	Soil* - Former Disposal Pits	Acceptable	None
	Soil* - Outside Active Burning Grounds	Acceptable	None
	Soil* - Active Burning Grounds	Acceptable	None
Future Trespasser/Visitor Adolescents	Soil* - Former Disposal Pits	Acceptable	None
	Soil* - Outside Active Burning Grounds	Acceptable	None
	Soil* - Active Burning Grounds	Acceptable	None
Future Resident - Adult	Soil* - Former Disposal Pits	Acceptable	None
	Soil* - Outside Active Burning Grounds	Acceptable	None
Future Resident - Child	Soil* - Former Disposal Pits	Unacceptable (noncarcinogenic)	Iron, TCE, aluminum, arsenic, manganese, thallium, and vanadium
	Soil* - Outside Active Burning Grounds	Unacceptable (noncarcinogenic and lead)	Lead, cadmium, iron, manganese, vanadium, TCE, aluminum, antimony, arsenic, chromium, copper, mercury, and thallium
Future Resident - Child/Adult	Soil* - Former Disposal Pits	Unacceptable (carcinogenic)	Dioxin, TCE, arsenic
	Soil* - Outside Active Burning Grounds	Unacceptable (carcinogenic)	PAHs, dioxin, TCE, PCE, and arsenic
Future Construction Worker	Soil* - Former Disposal Pits	Acceptable	None
	Soil* - Outside Active Burning Grounds	Unacceptable (Lead)	Lead
	Soil* - Active Burning Grounds	Acceptable	None
Current/Future Recreational Person - Adult	Surface Water - North Branch Potomac River Adjacent to Site 1	Acceptable	None
	Sediment - North Branch Potomac River Adjacent to Site 1	Acceptable	None
Current/Future Recreational Person - Adolescents	Surface Water - North Branch Potomac River Adjacent to Site 1	Acceptable	None
	Sediment - North Branch Potomac River Adjacent to Site 1	Acceptable	None

Notes:
Information summarized from the 2006 focused Remedial Investigation
* Combined surface and subsurface soil
PAH - polyaromatic hydrocarbon
PCE - tetrachloroethene
TCE - trichloroethene

Table 2-2
Summary of Ecological Risk Assessment
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Constituent of Concern	Upland (ABG/FDP)		Floodplain (OABG)	
	Surface Soil	Food Web	Surface Soil	Food Web
VOCs				
1,2-dichloroethene			X	
Methyl acetate			X	
Trichloroethene			X	
SVOCs				
2-nitroaniline	X			
PAHs			X	
Dioxin/furans				
Total dioxin/furans (TEQ)				X
Explosives				
1,3,5-trinitrobenzene	X			
HMX	X		X	
Nitroglycerin	X		X	
Perchlorate	X			
RDX	X		X	
Metals				
Cadmium			X	X
Chromium			X	
Copper	X		X	
Lead	X		X	X
Mercury	X		X	X
Nickel			X	
Silver			X	
Vanadium			X	
Zinc			X	X

Notes:

Information summarized from the 2006 focused Remedial Investigation

ABG - active burning ground

FDP - former disposal pit

HMX - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

OABG - outside active burning ground

PAH - polyaromatic hydrocarbon

RDX - Hexahydro-1,2,5-trinitro-1,3,5-triazine

SVOC - semivolatile organic compound

TEQ - toxic equivalency quotient

VOC - volatile organic compound

Table 2-3
Summary of Soil-to-Groundwater Leaching for the ABG
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Constituent of Concern	Active Burning Grounds		Former Disposal Pits	
	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil
VOCs				
1,1-dichlorothene				X
Tetrachloroethene	X	X		X
Trichloroethene	X	X	X	X
SVOCs				
2-nitroaniline	X			
Explosives				
1,3,5-trinitrobenzene	X			
Nitroglycerin	X	X		
RDX	X	X	X	X
Metals				
Antimony		X		
Cobalt	X	X	X	X
Iron	X	X	X	X
Lead	X	X		
Manganese	X	X	X	X

Notes:

Information summarized from the 2013 SRG Tech Memo (CH2M HILL, 2013)

RDX - Hexahydro-1,2,5-trinitro-1,3,5-triazine

SVOC - semivolatile organic compound

VOC - volatile organic compound

Table 2-4
Summary of Soil-to-Groundwater Leaching for the OABG
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Constituent of Concern	Western OABG		Central OABG	Eastern OABG	
	Surface Soil	Subsurface Soil	Subsurface Soil	Surface Soil	Subsurface Soil
Volatile Organic Compounds					
1,2,4-trichlorobenzene[1]					X
Bromodichloromethane[1]				X	
trans-1,2-dichloroethene				X	
Tetrachloroethene				X	
Trichloroethene	X	X		X	X
Semivolatile Organic Compounds					
1,1-biphenyl		X			
benzo(b)fluoranthene		X			
Naphthalene[1]		X			
Explosives					
Nitroglycerin				X	X
RDX				X	X
Metals					
Cadmium				X	X
Cobalt	X	X	X	X	X
Copper				X	
Iron	X	X		X	X
Lead	X			X	X
Mercury					X

Notes:

Information summarized from the 2013 SRG Tech Memo (CH2M HILL, 2013)

[1] COC based on leaching concern documented in the Revised Draft Proposed RAOs and Remediation Goals for Site 1 Soil (CH2M HILL, 2009)

OABG - outside active burning ground

RDX - Hexahydro-1,2,5-trinitro-1,3,5-triazine

TABLE 2-5

SRG Selection Process for the ABG

Site 1 (OU-4) Soil Feasibility Study

Allegany Ballistics Laboratory, Rocket Center, WV

COCs[1]	Background[2] (mg/kg)	PRG[7] (mg/kg)			SSL[3] (mg/kg)	SRG[6] (mg/kg)	
		Residential	Industrial	Ecological		Industrial Scenario	Basis
VOCs							
1,1-Dichloroethene	NA	Not a COC	Not a COC	Not a COC	0.18	0.18	SSL
Tetrachloroethene	NA	Not a COC	Not a COC	Not a COC	0.22	0.22	SSL
Trichloroethene	NA	2.5	4	Not a COC	0.16	0.16	SSL
SVOCs							
2-Nitroaniline	NA	Not a COC	Not a COC	Insufficient Data[5]	0.70	Constituent was only detected in 2 of 70 soil samples.	
Dioxins							
2,3,7,8-TCDD TEQ[4]	NA	2.5×10^{-5}	1.8×10^{-4}	Not a COC	2.5E-03	1.8×10^{-4}	Industrial PRG
Explosives							
1,3,5-Trinitrobenzene	NA	Not a COC	Not a COC	Insufficient Data[5]	26	Constituent was only detected in 2 of 69 soil samples.	
HMX	NA	Not a COC	Not a COC	10	150	10 (SS)	Ecological PRG
Nitroglycerin	NA	Not a COC	Not a COC	65	0.072	65 (SS)	Ecological PRG
Perchlorate	NA	53	671	1.0	0.85	0.85	SSL
RDX	NA	Not a COC	Not a COC	10	0.024	10 (SS)	Ecological PRG
Metals							
Antimony	1.2 (SS/SB)	Not a COC	Not a COC	Not a COC	12	Antimony is not a COC based on human and ecological receptor exposure risk and the potential for concentrations in soil leaching to groundwater at levels resulting in unacceptable risk based on the SSL evaluation is not a concern.	
Arsenic	10.9 (SS/SB)	3.9	16	Not a COC	13	Although constituent concentrations in groundwater fluctuate above the MCL, the maximum concentration in soil is below background.	
Cobalt	20.9 (SS/SB)	Not a COC	Not a COC	Not a COC	2.0	Although constituent present in groundwater above the RSL, the maximum concentration in soil is below background.	
Copper	36.7 (SS/SB)	Not a COC	Not a COC	253	2,100	253 (SS)	Ecological PRG
Iron	27,900 (SS) 30,900 (SB)	53,259	671,107	Not a COC	6,400	Maximum soil concentrations are only slightly above background for ABL and iron is considered an essential human nutrient.	
Lead	44.4 (SS) 22.5 (SB)	Not a COC	Not a COC	785	160	160	SSL
Manganese	1,090 (SS) 852 (SB)	1,087	8,445	Not a COC	480	1,090 (SS) 852 (SB)	Background
Mercury	0.31 (SS/SB)	Not a COC	Not a COC	1.61	7.6	1.61 (SS)	Ecological PRG

TABLE 2-5

SRG Selection Process for the ABG

Site 1 (OU-4) Soil Feasibility Study

Allegany Ballistics Laboratory, Rocket Center, WV

COCs[1]	Background[2] (mg/kg)	PRG[7] (mg/kg)			SSL[3] (mg/kg)	SRG[6] (mg/kg)	
		Residential	Industrial	Ecological		Industrial Scenario	Basis
Thallium	2.3 (SS) 2.1 (SB)	0.38	4.8	Not a COC	6.8	Maximum soil concentration is below the industrial PRG.	
Vanadium	17.8 (SS/SB)	190	2,397	Not a COC	360	Maximum soil concentrations are below the PRGs and SSL.	

Notes:

Information summarized from the SRG Technical Memorandum (CH2M HILL, 2013)

[1] The COC list was generated using the constituents presented in the Revised Draft Proposed RAOs and Remediation Goals for Site 1 Soil (CH2M HILL, 2009)

[2] The background values are taken from Table 3-10 in the Background Soil Investigation Technical Memorandum (CH2M HILL, 2004b)

[3] The SSL values were generated based on site-specific leaching conditions and a DAF of 46.

[4] 2,3,7,8-TCDD TEQ - The ecological PRG is based upon 2,3,7,8-TCDD equivalents, mammalian TEFs, and individual dioxin/furan congeners. The human health 2,3,7,8-TCDD TEQ PRG is based on 2,3,7,8-TCDD, the most toxic

[5] There was insufficient data to develop the PRG for this compound.

[6] The SRG was determined as the lowest concentration between the PRGs and SSL; and then the higher value between that number and the background.

[7] PRGs for residential and industrial human receptors and ecological receptors were calculated following risk assessment methods documented in the f *ocused Remedial Investigation for Site 1 Soil (CH2M HILL, 2006)*

µg/L = microgram per liter
COC = constituent of concern
DAF = dilution attenuation factor
FDP = former disposal pit
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
LTM = long-term monitoring
MCL = maximum contaminant level
mg/kg = milligram per kilogram
NA = not applicable/not available
Not a COC = constituent is not a COC for the respective risk pathway
PRG = preliminary remediation goal
RCRA = Resource Concervation and Recovery Act
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
ROD = Record of Decision
RSL = Regional Screening Level
SB = subsurface soil
SRG = site remediation goal
SS = surface soil
SSL = soil screening level
SS/SB = combined surface and subsurface soil
SVOC = semivolatile organic compound
TCDD = Tetrachlorodibenzo-p-dioxin
TEF = toxic equivalence factor
TEQ = toxic equivalency quotient
VOC = volatile organic compound

TABLE 2-6

SRG Selection for the OABG

Site 1 (OU-4) Soil Feasibility Study

Allegany Ballistics Laboratory, Rocket Center, WV

COCs[1]	Background[2] (mg/kg)	PRG[8] (mg/kg)			SSL[3] (mg/kg)	SRG[7] (mg/kg)	
		Residential	Industrial	Ecological		Industrial Scenario	Basis
VOCs							
1,2,4-Trichlorobenzene	NA	Not a COC	Not a COC	Not a COC	170	Maximum soil concentration is below PRGs and SSL.	
1,2-Dichloroethene[6]	NA	Not a COC	Not a COC	0.45	8.4	0.45 (SS) 8.4 (SB)	Ecological PRG SSL
Bromodichloromethane	NA	Not a COC	Not a COC	Not a COC	8.3	Maximum soil concentration is below SSL.	
Methyl acetate	NA	Not a COC	Not a COC	0.30	84	0.30 (SS)	Ecological PRG
Tetrachloroethene	NA	37	61	Not a COC	1.1	1.1	SSL
Trichloroethene	NA	2.5	4	2.5	0.81	0.81	SSL
SVOCs							
Benzo(a)anthracene	NA	1.5	21	Not a COC	8.8	8.8	SSL
Benzo(a)pyrene	NA	0.15	2.1	Not a COC	200	2.1	Industrial PRG
Benzo(b)fluoranthene	NA	1.5	21	Not a COC	30	21	Industrial PRG
Benzo(k)fluoranthene	NA	15	211	Not a COC	290	Maximum soil concentration is below the industrial PRG and SSL.	
Dibenz(a,h)anthracene	NA	0.15	2.1	Not a COC	9.6	2.1	Industrial PRG
Indeno(1,2,3-cd)pyrene	NA	1.5	21	Not a COC	97	Maximum soil concentration is below the industrial PRG and SSL.	
Naphthalene	NA	Not a COC	Not a COC	Not a COC	1.9	Maximum soil concentration is below SSL.	
Total PAHs (low molecular weight)	NA	Not a COC	Not a COC	29	NA	29 (SS)	Ecological PRG
Total PAHs (high molecular weight)	NA	Not a COC	Not a COC	18	NA	18 (SS)	Ecological PRG
Dioxins							
2,3,7,8-TCDD TEQ[4]	NA	2.5×10^{-5}	1.8×10^{-4}	9.6×10^{-5}	0.013	9.6×10^{-5} (SS) 1.8×10^{-4} (SB)	Ecological PRG Industrial PRG
Explosives							
HMX	NA	Not a COC	Not a COC	10	750	10 (SS)	Ecological PRG
Nitroglycerin	NA	Not a COC	Not a COC	65	0.37	0.37	SSL
Perchlorate	NA	Not a COC	Not a COC	Not a COC	4.35	Maximum soil concentration is below the SSL	
RDX	NA	Not a COC	Not a COC	10	0.12	0.12	SSL
Metals							
Antimony	1.2 (SS/SB)	26	284	Not a COC	64	Maximum soil concentration is below PRGs and SSL.	
Arsenic[10]	15.1 (SS) 10.9 (SB)	3.9	16	Not a COC	69	16	Industrial PRG
Cadmium	0.55 (SS) 0.34 (SB)	70	792	17.4	130	17.4 (SS) 130 (SB)	Ecological PRG SSL
Chromium[5]	13.9 (SS/SB)	37,199	252,266	42.7	1.0×10^{6}	42.7 (SS)	Ecological PRG
Cobalt[10]	52.3 (SS) 20.9 (SB)	Not a COC	Not a COC	Not a COC	10	52.3 (SS) 20.9 (SB)	Background Background
Copper	36.7 (SS/SB)	1,522	19,174	253	11,000	253 (SS) 11,000 (SB)	Ecological PRG SSL
Iron[10]	35,600 (SS) 30,900 (SB)	26,629	335,553	Not a COC	33,000	35,600 (SS) 33,000 (SB)	Background SSL
Lead	44.4 (SS) 22.5 (SB)	418	1,235	785	830	785 (SS) 830 (SB)	Ecological PRG SSL
Manganese	1,090 (SS) 852 (SB)	543	4,222	Not a COC	2,500	Maximum soil concentration is below PRGs and SSL.	
Mercury	0.31 (SS/SB)	8.4	79	1.61	39	1.61 (SS) 39 (SB)	Ecological PRG SSL
Nickel[9]	32.4 (SS) 23 (SB)	Not a COC	Not a COC	78.4	3,100	78.4 (SS)	Ecological PRG

TABLE 2-6

SRG Selection for the OABG

Site 1 (OU-4) Soil Feasibility Study

Allegany Ballistics Laboratory, Rocket Center, WV

COCs[1]	Background[2] (mg/kg)	PRG[8] (mg/kg)			SSL[3] (mg/kg)	SRG[7] (mg/kg)	
		Residential	Industrial	Ecological		Industrial Scenario	Basis
Silver	NA	Not a COC	Not a COC	42.6	220	42.6 (SS)	Ecological PRG
Thallium	2.1 (SS/SB)	0.38	4.8	Not a COC	35	Maximum soil concentration is below PRGs and SSL.	
Vanadium	17.8 (SS/SB)	190	2,397	173	1,800	173 (SS)	Ecological PRG
Zinc	136 (SS) 68.6 (SB)	Not a COC	Not a COC	1,170	17,000	1,170 (SS)	Ecological PRG

Notes:

Information summarized from the SRG Technical Memorandum (CH2M HILL, 2013)

[1] The COC list was generated using the constituents presented in the Revised Draft Proposed RAOs and Remediation Goals for Site 1 Soil (CH2M HILL, 2009)

[2] The background values are taken from Table 3-10 in the Background Soil Investigation Technical Memorandum (CH2MHILL, 2004b)

[3] The SSL values were based on site-specific leaching conditions based on site specific input parameters resulting in a DAF of 236.

[4] 2,3,7,8-TCDD TEQ - The ecological PRG is based upon 2,3,7,8-TCDD equivalents, mammalian TEFs, and individual dioxin/furan congeners. The human health 2,3,7,8-TCDD TEQ PRG is based on 2,3,7,8-TCDD, the most toxic dioxin/furan congener.

[5] The human health PRG for chromium was based on chromium III toxicity numbers. The ecological PRG for chromium was based on total chromium. There has not been analysis of CrVI at Site 1 because there is no historical indication of a source

[6] Considered total 1,2-dichloroethene (cis-1,2-ichloroethene + trans-1,2-dichloroethene); however, there is no SSL for total 1,2-dichloroethene. The lower SSL between cis-1,2-dichloroethene (8.4 mg/kg) and trans-1,2-dichloroethene (12 mg/kg) was

[7] The SRG was determined as the lowest concentration between the PRGs and SSL; and then the higher value between that number and the background

[8] PRGs for residential and industrial human receptors and ecological receptors were calculated following risk assessment methods documented in the fc*cused Remedial Investigation for Site 1 Soil (CH2M HILL, 2006)*

[9] Ecological PRG for nickel is based upon the maximum reference concentration collected from the river floodplain during the remedial investigation.

[10] Because arsenic, cobalt, iron, and thallium had SRGs based on background, the maximum values from the reference (i.e., background) samples collected from the river floodplain during the remedial investigation were used as background values (except for thallium, which was not detected in reference samples) rather than the background concentrations from the area outside the floodplain. This slightly increased the surface soil SRG for arsenic, cobalt, and iron in the OABG.

COC - constituent of concern
DAF - dilution attenuation factor
HMX - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
mg/kg -milligram per kilogram
NA - not applicable/not available
Not a COC - constituent is not a COC for the respective risk pathway
PRG - preliminary remediation goal
RAO - remedial action objective
RDX -Hexahydro-1,2,5-trinitro-1,3,5-triazine
SB - subsurface soil
SRG - site remediation goal
SS -surface soil
SS/SB - combined surface and subsurface soil
SSL - soil screening level
SVOC - semi-volatile organic compound
TCDD - tetrachlorodibenzo-p-dioxin
TEF - toxic equivalence factor
TEQ - toxic equivalency quotient
VOC - volatile organic compound

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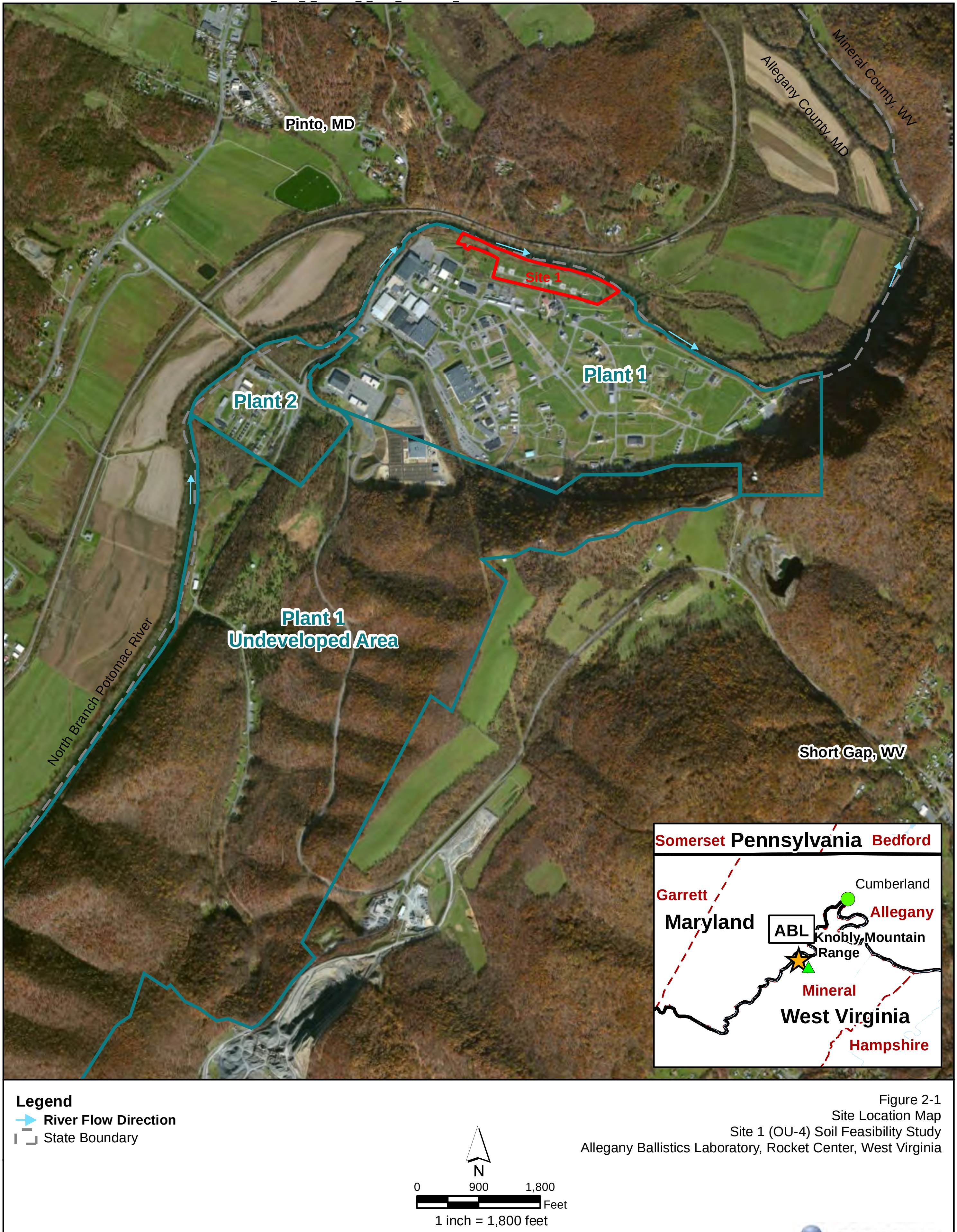
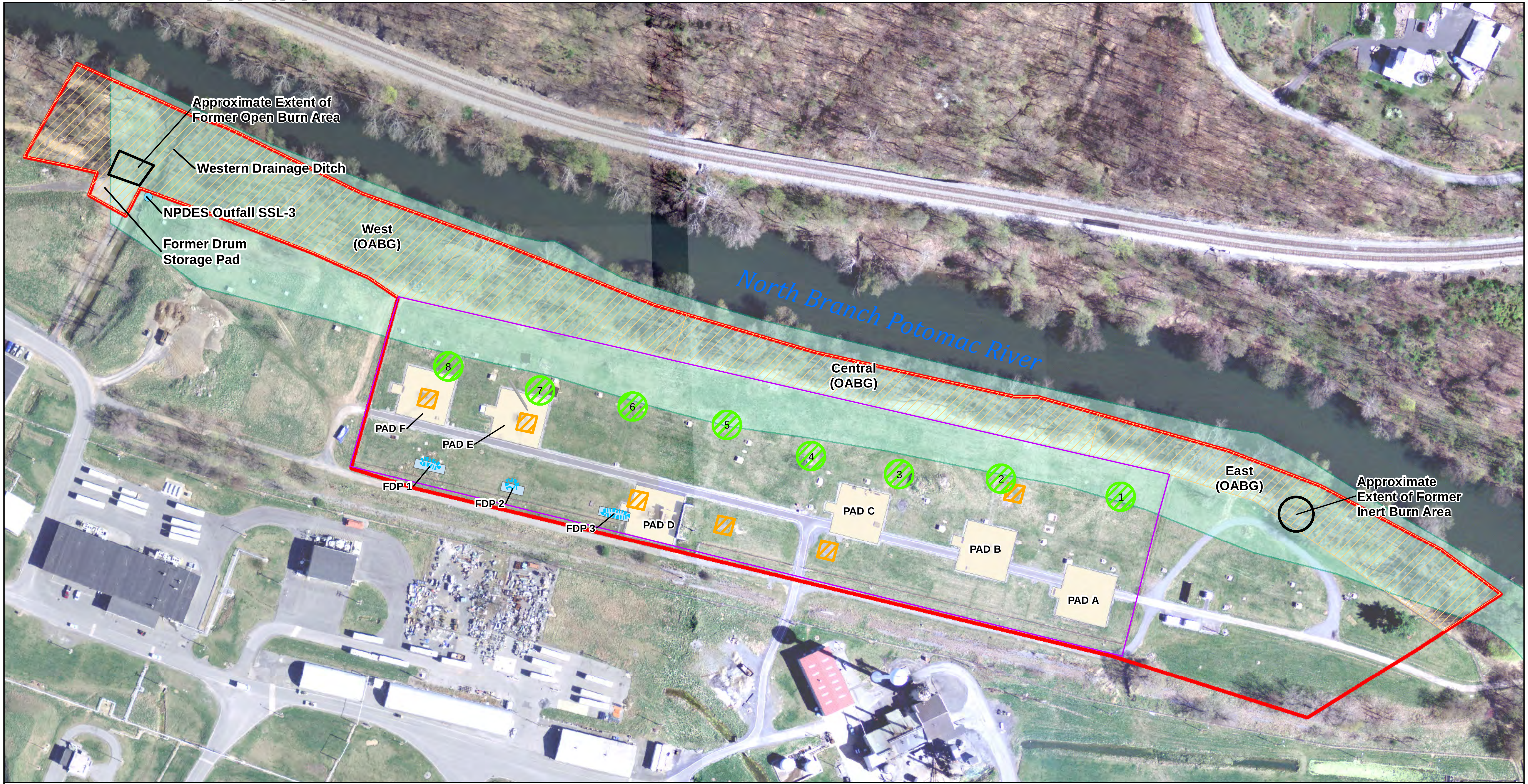


Figure 2-1
Site Location Map
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

R:\USNAVFACENGCOM405450\ABL\MAPFILES\390451_SITE_1_FS\FIG2_2_SITE_LAYOUT.MXD BALDRIDGE 4/29/2013 12:35:27 PM



Legend
- NPDES Outfall SSL-3
- Former Inert and Open Burn Area
- Former Disposal Pits (FDP)
- Former Earthen Burn Pads
- Active Burning Ground
- Approximate location of former burn pans
- Outside Active Burning Ground (OABG)
- Current Concrete Burn Pads
- 100 Year Floodplain
- Site 1 Boundary

N

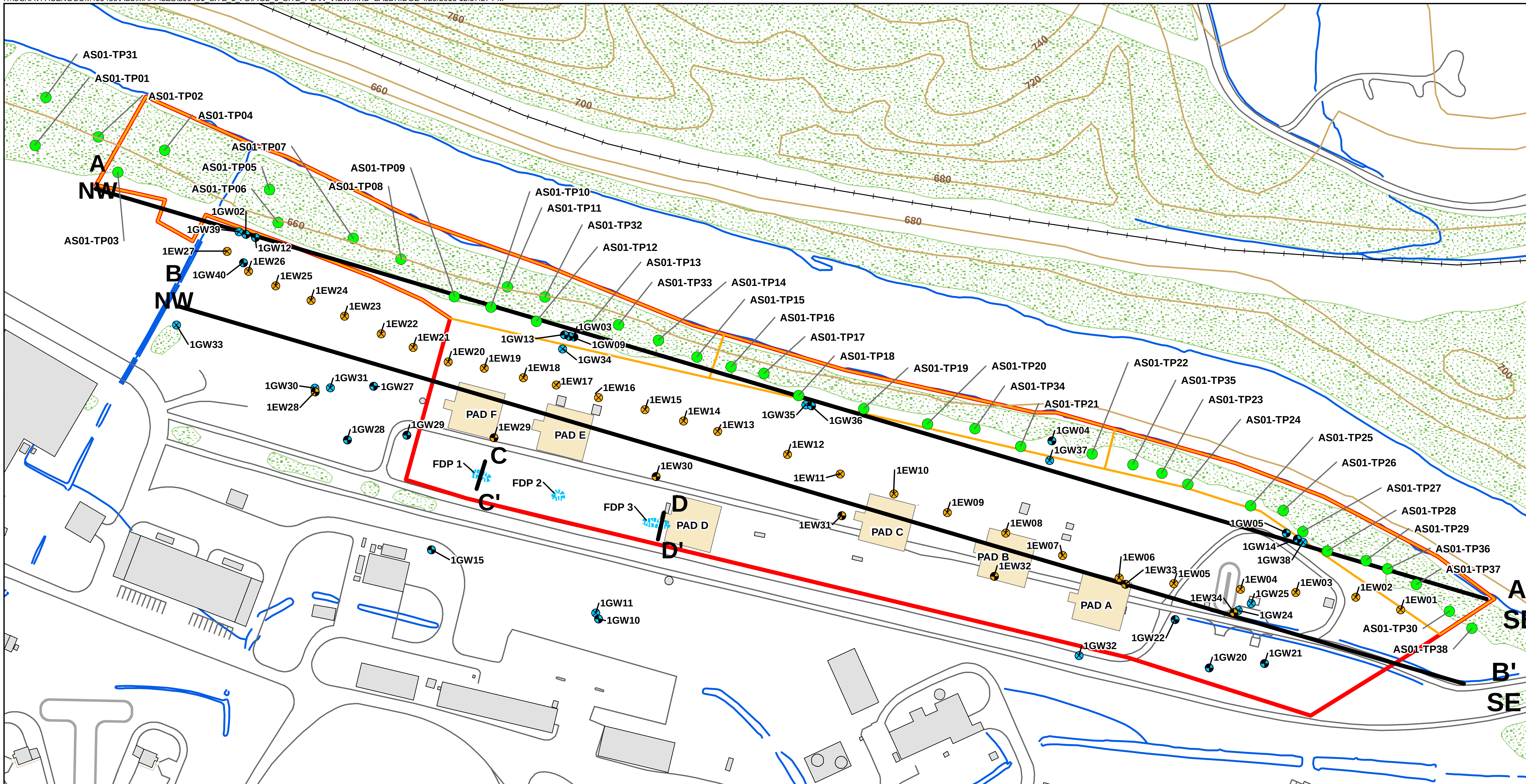
0 75 150 Feet

1 inch = 150 feet

Figure 2-2
Site 1 Layout
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

R:\USNAVFACENGCOM405450\ABL\MAPFILES\390451_SITE_1_FS\FIG2_3_SITE_PLAN_VIEW.MXD BALDRIDGE 4/29/2013 12:37:27 PM



Legend

- Test Pits
- Monitoring Well - Alluvial
- Monitoring Well - Hybrid
- Monitoring Well - Bedrock
- Extraction Well - Bedrock
- Extraction Well - Alluvial
- Surface Water
- Railroad
- Elevation Contour (20 ft Interval)
- OABG Regions
- Approximate location of current burn pads
- Structures
- Vegetation
- Site 1 Boundary

N

0 80 160 Feet

1 inch = 160 feet

Figure 2-3
Site 1 Plan View
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

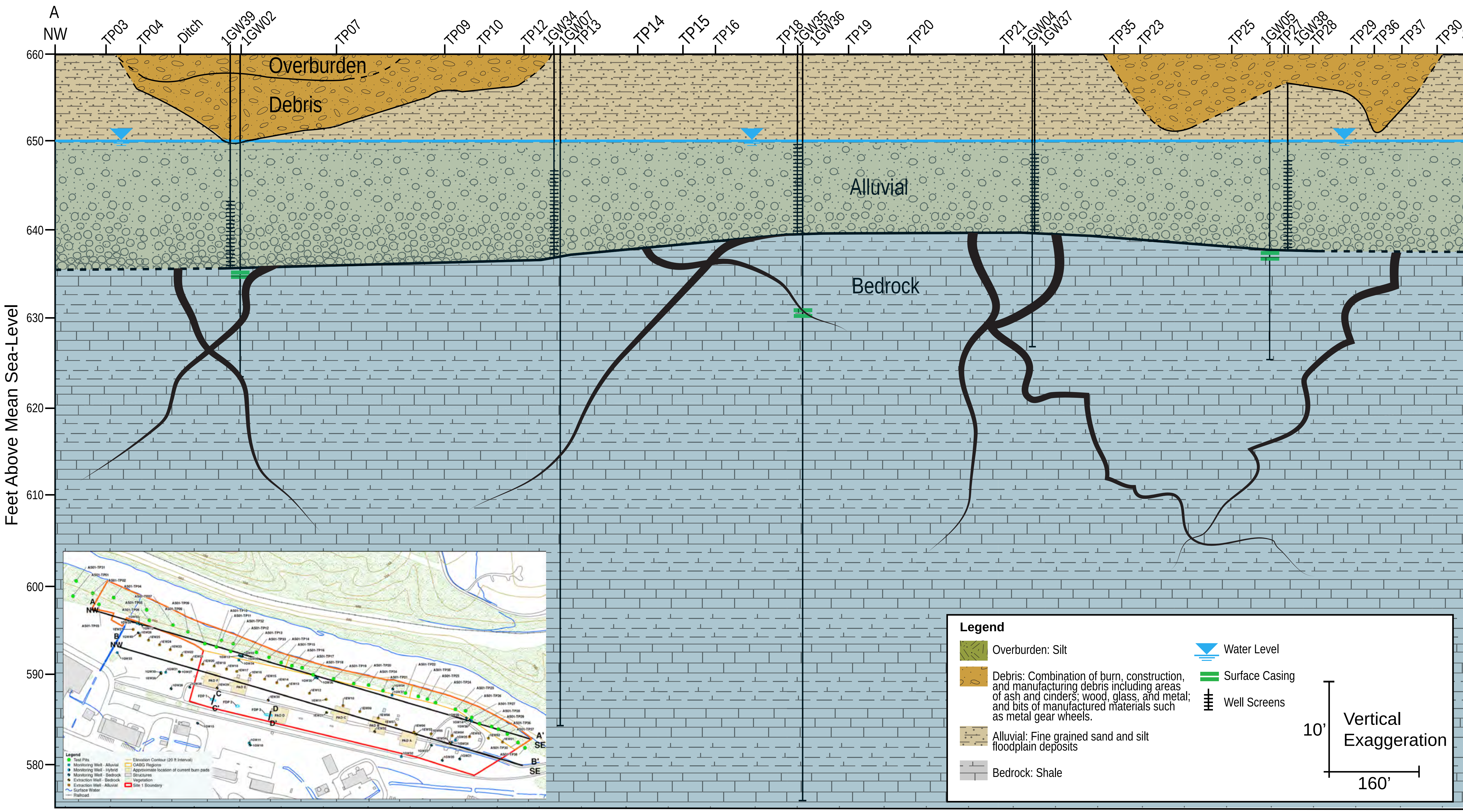


Figure 2-4
Site 1 Cross Section A-A'
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

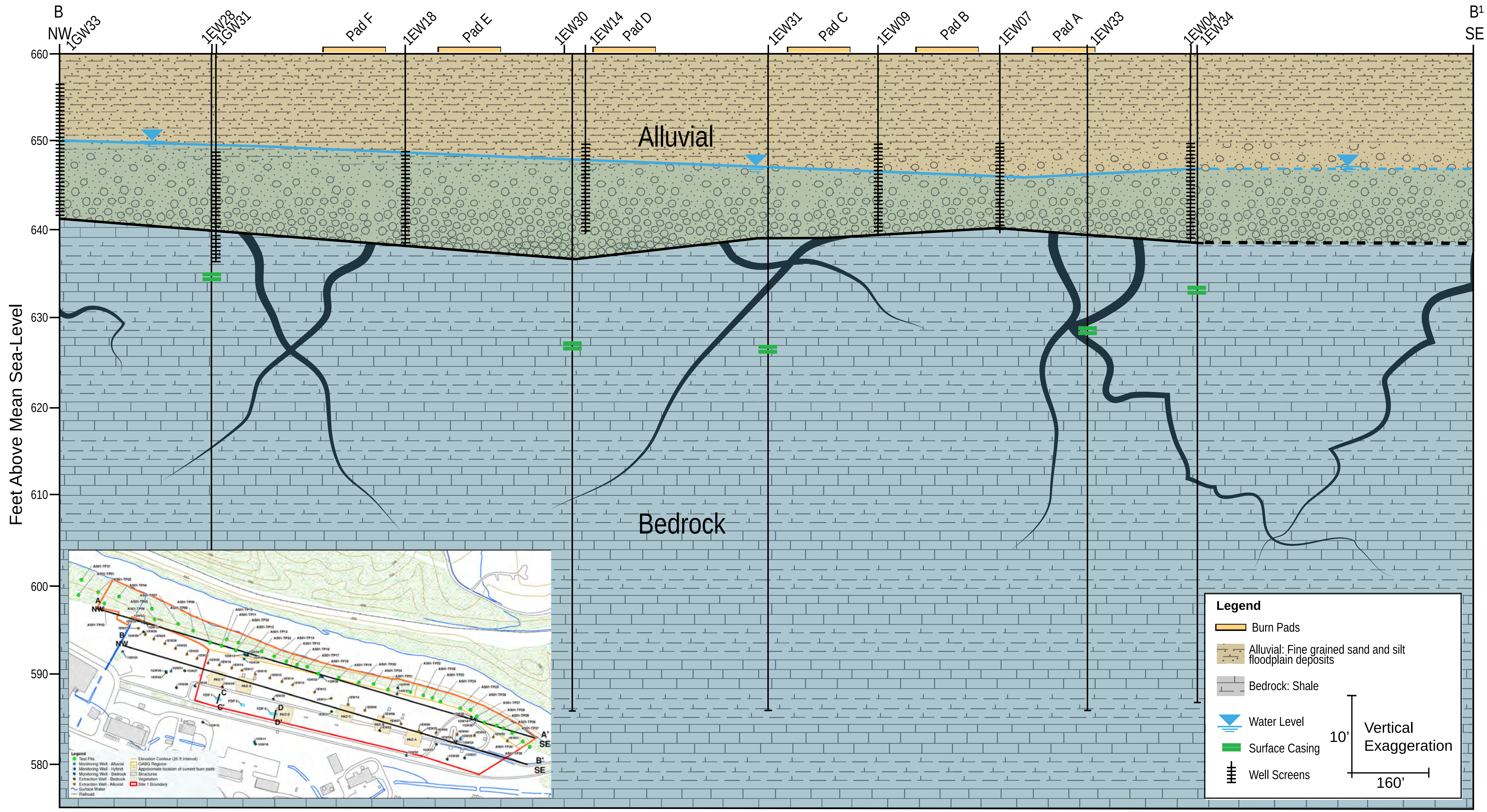
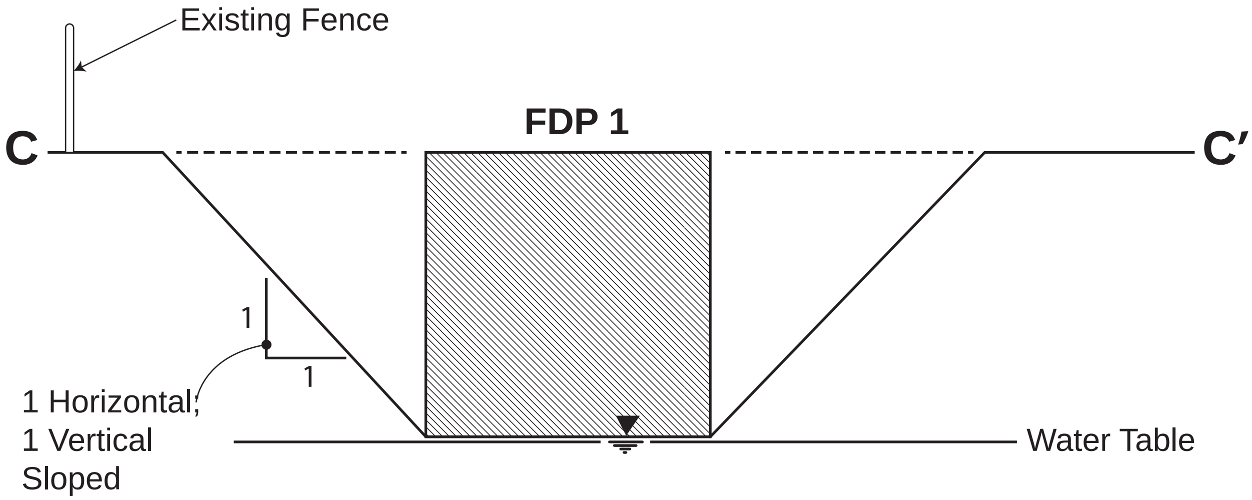
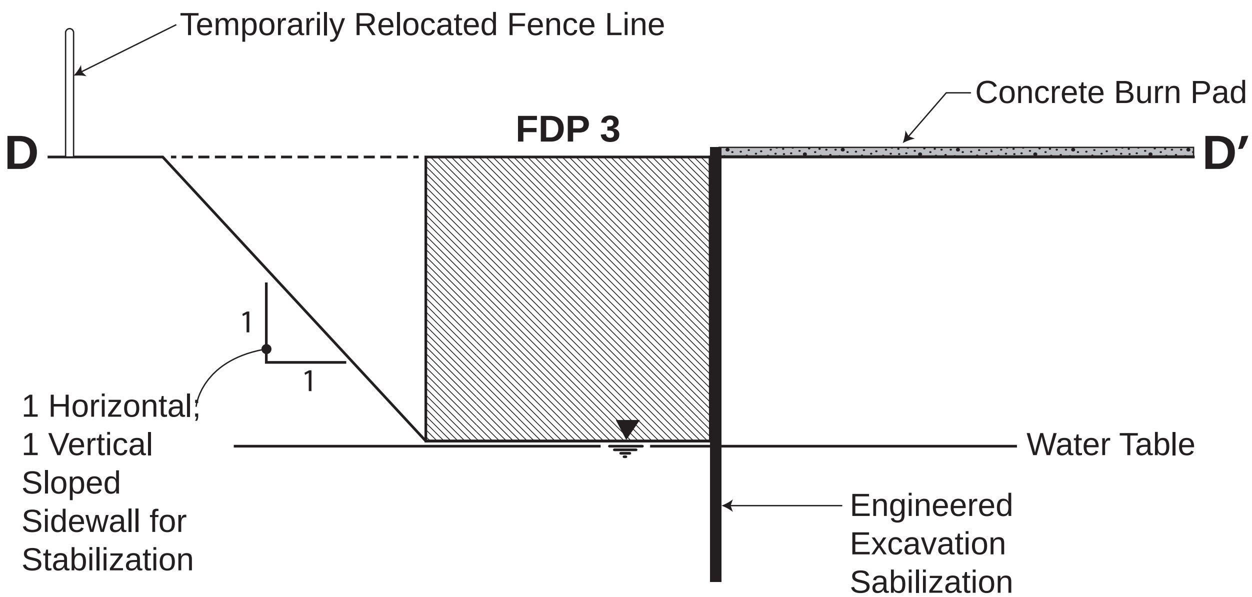


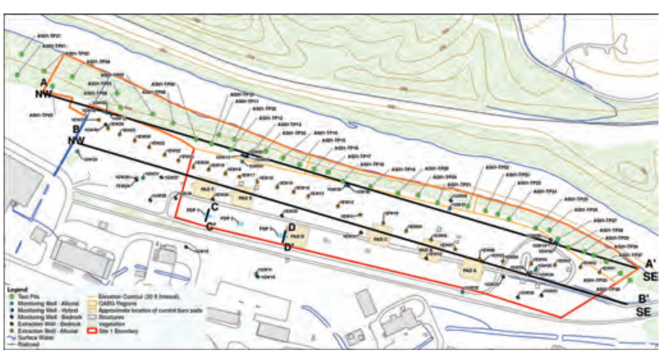
Figure 2-5
Site 1 Cross Section B-B'
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia



Cross Section C-C′



Cross Section D-D′



Notes:

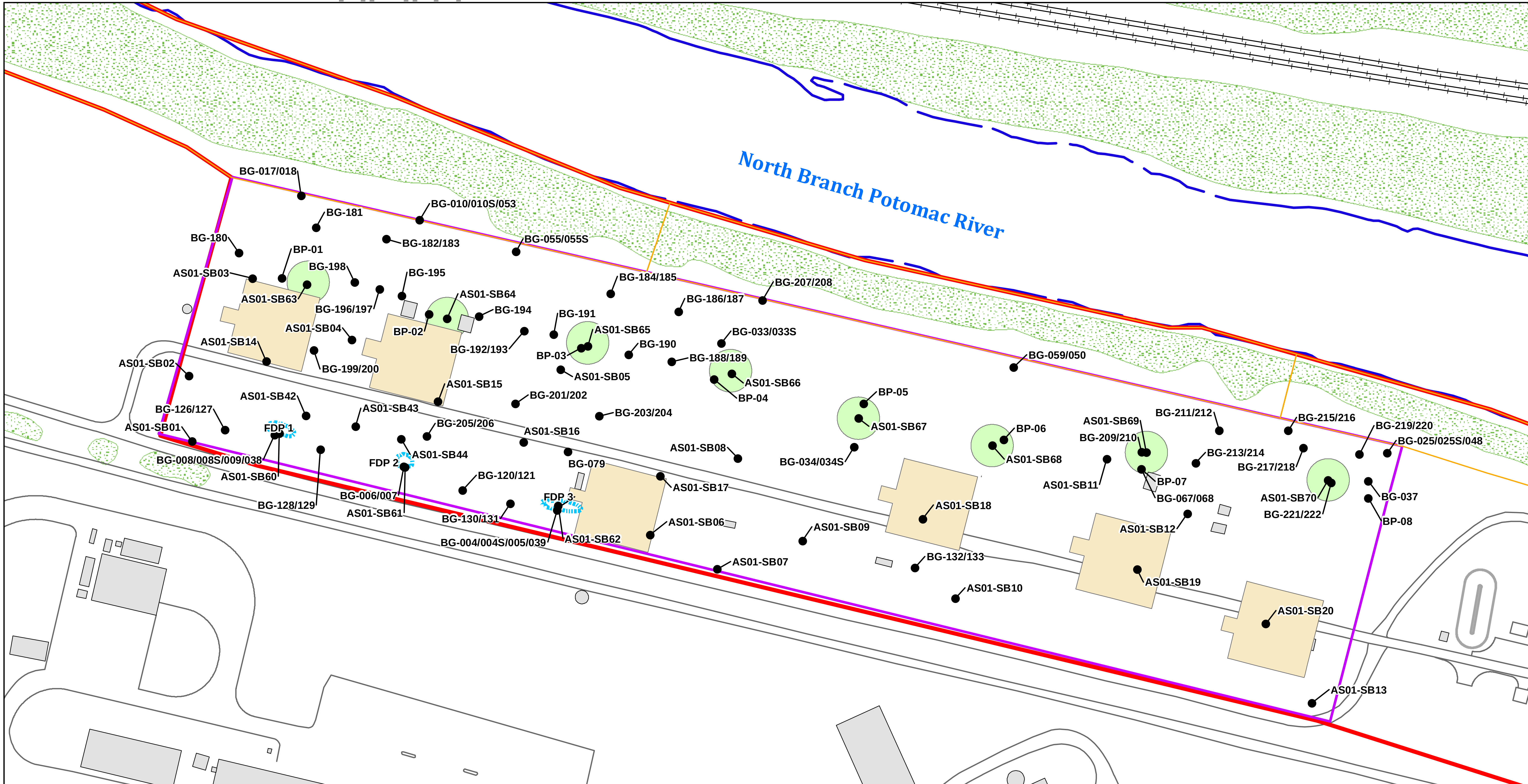
1.) A Non-time critical removal action (NTCRA) has been initiated to address potential sources of groundwater contamination in the unsaturated soil at FDPs 1 and 3 in accordance with the Engineering Evaluation and Cost Analysis and Action Memorandum (CH2M HILL, 2012).

Legend

FDP Removal Area

FIGURE 2-6
Site 1 Cross Sections C-C’ and D-D’
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\390451_SITE_1_FS\FIG2_7_ABG_SOIL_SAMPLES.MXD BALDRIDGE 4/23/2013 5:50:44 PM



Legend

- Sample location included in the ABG data set
- Water
- Roads
- Railroads
- Former Earthen Burn Pads
- Former Disposal Pits (FDP)
- Structures
- Current Concrete Burn Pads
- Outside Active Burning Ground
- Active Burning Ground
- Site 1 Boundary
- Vegetation

N

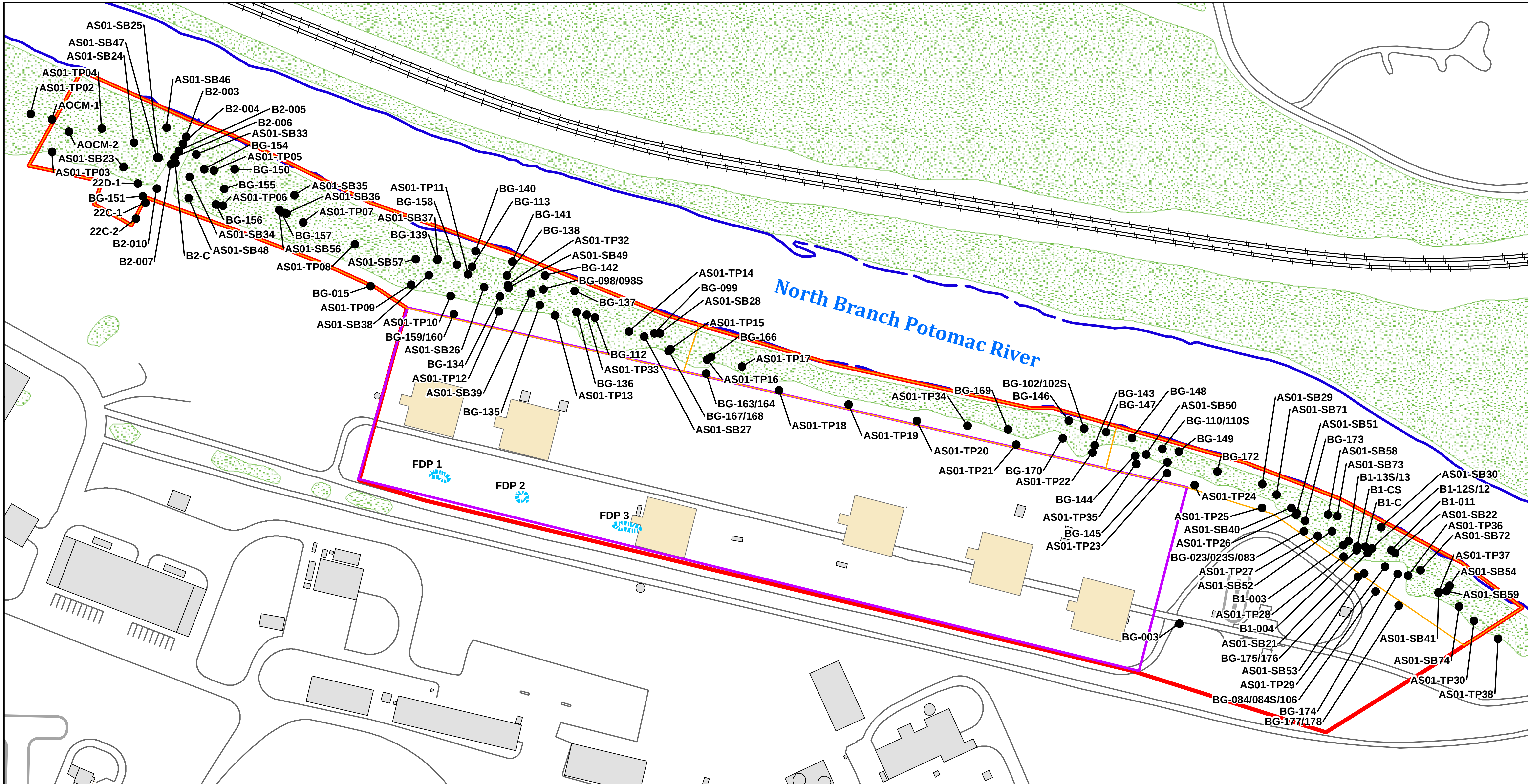
0 50 100 Feet

1 inch = 100 feet

Figure 2-7
Site 1 ABG Soil Sample Locations
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

R:\USNAVFACENGCOM405450\ABL\MAPFILES\390451_SITE_1_FS\FIG2_8_OABG_SOIL_SAMPLES.MXD BALDRIDGE 4/29/2013 12:39:53 PM



Legend

- Sample location included in the OABG data set
- Water
- Roads
- Railroads
- Former Disposal Pits (FDP)
- Structures
- Current Concrete Burn Pads
- Outside Active Burning Ground
- Active Burning Ground
- Site 1 Boundary
- Vegetation

Figure 2-8
Site 1 OABG Soil Sample Locations
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\390451_SITE_1_FS\FIG2_9_ESTIMATED_EXTENT_OF_DEBRIS_EAST.MXD BALDRIDGE 7/30/2013 12:07:00 PM

Legend

Test Pits
- Burn Debris / Ash
- Construction Debris
- Mfg Debris
- Native Soil
- Elevation Contours (1 ft interval)

- Subsurface Debris Area
- Active Burning Grounds
- Building
- OABG Region
- Site 1 Boundary

EM-31 Quadrature Geophysical Survey
- Red: Strong Metallic Response
- Orange: Metallic Response
- Yellow/Green: Natural Soil

N

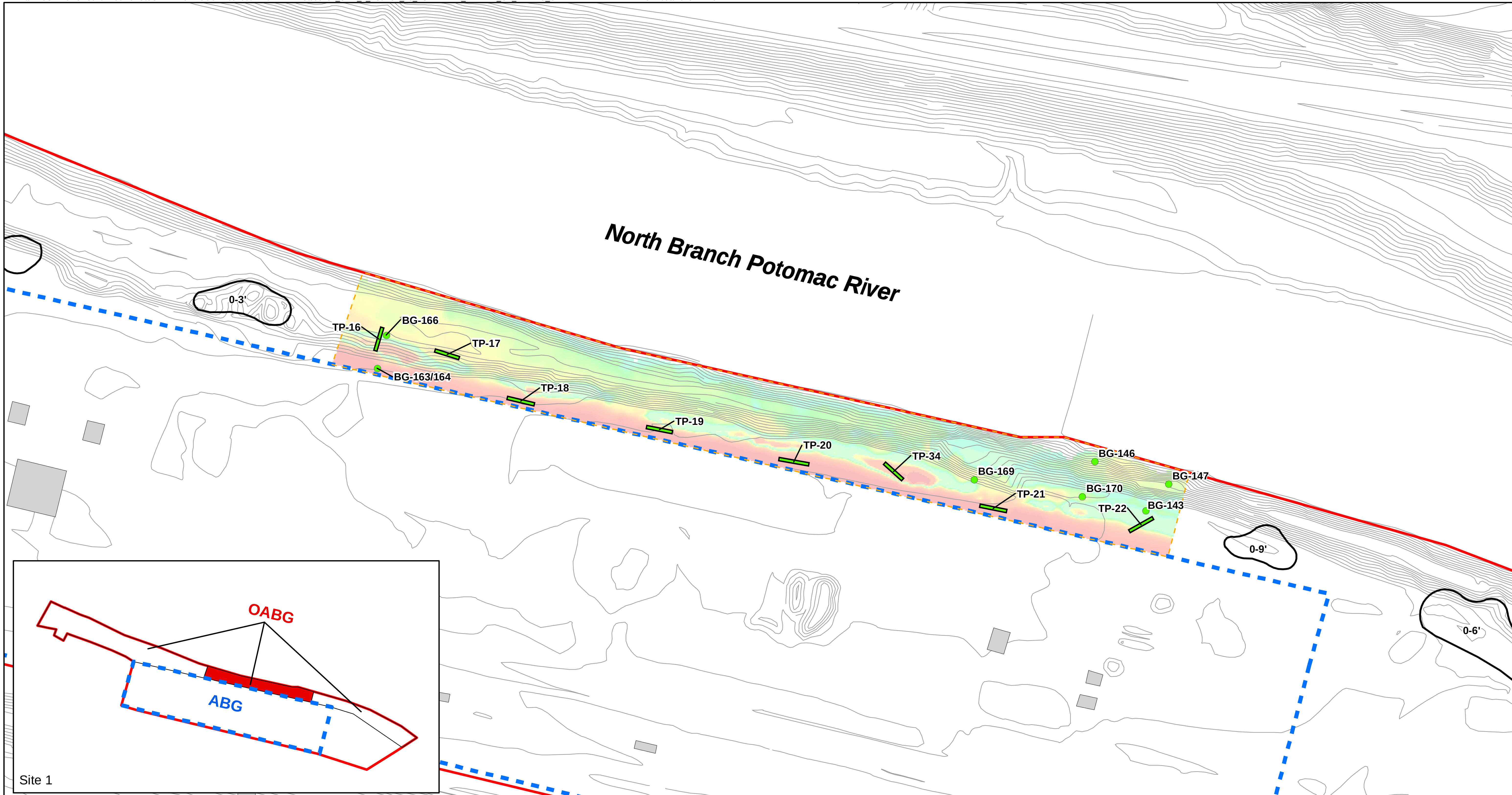
0 37.5 75 Feet

1 inch = 75 feet

Figure 2-9
Estimated Extent of West OABG Surface and Subsurface Debris
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\390451_SITE_1_FS\FIG2_10_ESTIMATED_EXTENT_OF_DEBRIS_CENTRAL.MXD BALDRIDGE 7/30/2013 2:24:37 PM



Legend

- Soil Sample Location
- Elevation Contours (1 ft interval)

Test Pits

- Burn Debris / Ash
- Construction Debris
- Mfg Debris
- Native Soil
- Subsurface Debris Area
- Active Burning Grounds
- Building
- OABG Region
- Site 1 Boundary

EM-31 Quadrature Geophysical Survey

- Red: Strong Metallic Response
- Orange: Metallic Response
- Yellow/Green: Natural Soil

N

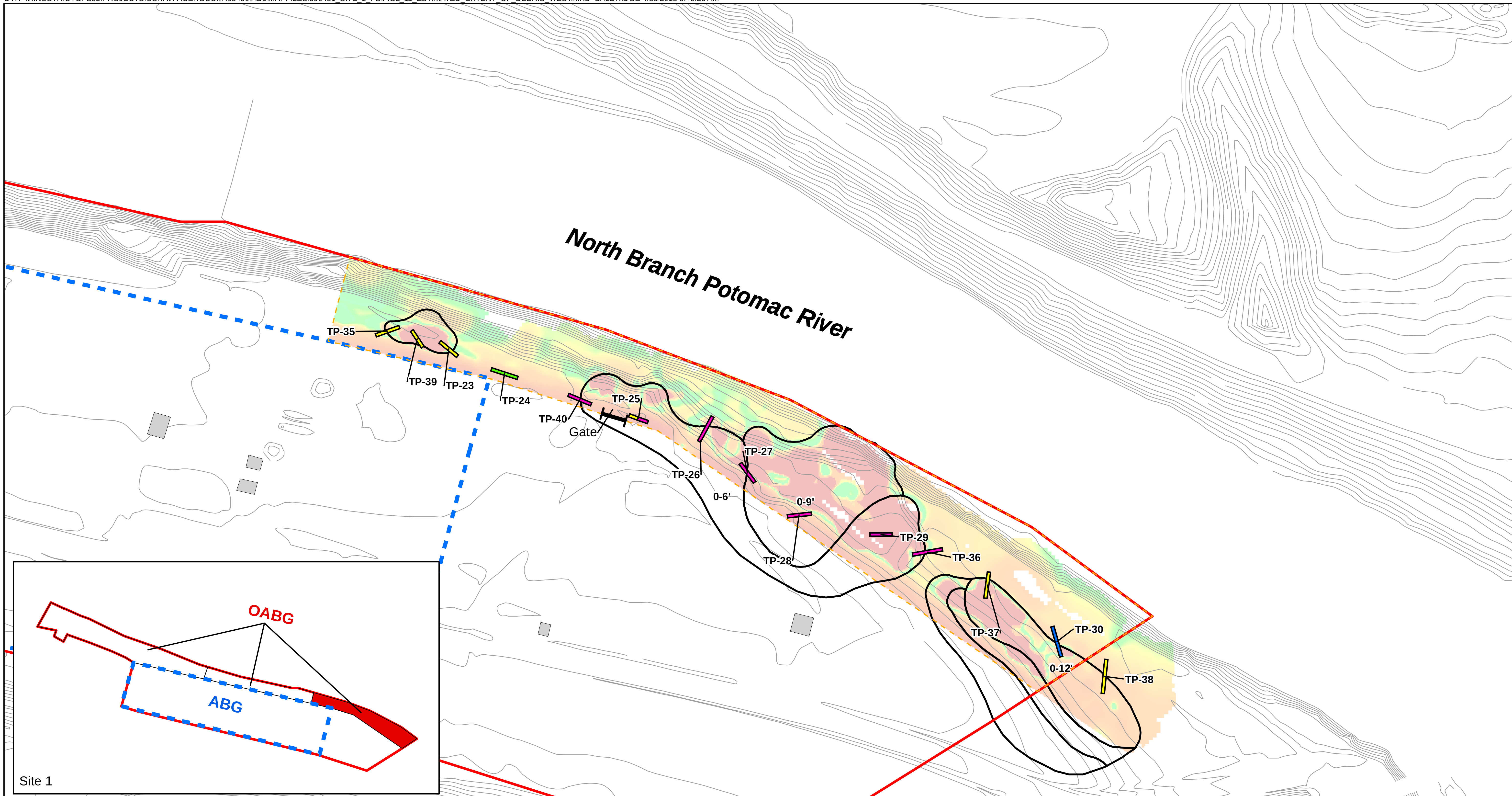
0 37.5 75 Feet

1 inch = 75 feet

Figure 2-10
Estimated Extent of Central OABG Surface and Subsurface Debris
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\390451_SITE_1_FS\FIG2_11_ESTIMATED_EXTENT_OF_DEBRIS_WEST.MXD BALDRIDGE 4/30/2013 8:49:26 AM



Legend

Test Pits

- Burn Debris / Ash
- Construction Debris
- Mfg Debris
- Native Soil
- Elevation Contours (1 ft interval)
- Active Burning Grounds
- Subsurface Debris Area
- Building
- Site 1 Boundary
- OABG Region

EM-31 Quadrature Geophysical Survey

- Red: Strong Metallic Response
- Orange: Metallic Response
- Yellow/Green: Natural Soil

N

0 37.5 75 Feet

1 inch = 75 feet

Figure 2-11
Estimated Extent of East OABG Surface and Subsurface Debris
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

SECTION 3

Remedial Action Objectives, Applicable or Relevant and Appropriate Requirements, and Areas of Concern

This section presents general and site-specific RAOs and identifies corresponding applicable or relevant and appropriate requirements (ARARs) for Site 1 soil. General RAOs are defined by the NCP (40 CFR 300.430 et seq.) and CERCLA (42 USC §§ 9601 et seq.), as amended by SARA. The NCP provides guidance and requirements for developing remedies.

CERCLA § 121(d) of SARA mandates that site remediation under CERCLA must achieve a level or standard of control for hazardous substances that at least attains such levels as specified in ARARs. Only promulgated federal and State of West Virginia laws and regulations can be considered ARARs. In addition to ARARs, proposed rules, guidance documents, directives, and similar documents that might affect a CERCLA remedial action are "to-be-considered" (TBC) criteria.

This section also describes the development of the SRGs and the areas of chemically contaminated soil, herein referred to as areas of concern (AOCs), where the SRGs were exceeded and the areas were considered to require remediation. The remedial alternatives for both the OABG and ABG, which are developed and evaluated within this FS and selected during development of the Proposed Remedial Action Plan and ROD, will be the final action under CERCLA. However, for the ABG, the selected remedial alternative is not intended to be the final action under RCRA. The RCRA closure requirements, provided in the RCRA Subpart X permit, will be met upon closure of the RCRA unit.

3.1 NCP Requirements and CERCLA Objectives

The NCP requires that the selected remedy meet the following objectives:

- Each remedial action selected shall be protective of human health and the environment (40 CFR 300.430 (f)(1)(ii)(A)).
- Onsite remedial actions that are selected must attain the ARARs identified at the time of the ROD signature (40 CFR 300.430(f)(1)(ii)(B)).
- Each remedial action selected shall be cost-effective, provided that it first satisfies the threshold criteria set forth in 40 CFR 300.430 (f)(1)(ii)(A) and (B). A remedy shall be cost-effective if its costs are proportional to its overall effectiveness (40 CFR 300.430 (f)(1)(ii)(D)).
- Each remedial action shall use permanent solutions and alternative treatment technologies or resource-recovery technology to the maximum extent practicable (40 CFR 300.430 (f)(1)(ii)(E)).

The statutory scope of CERCLA was amended by SARA to include the following general objectives for remedial action at all CERCLA sites:

- Remedial actions "…shall attain a degree of cleanup of hazardous substances, pollutants, and contaminants released into the environment and of control of further releases at a minimum which assures protection of human health and the environment" (CERCLA Section 121(d)).
- Remedial actions "…in which treatment that permanently and significantly reduces the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants is a principal element" (CERCLA Section 121(b)) are preferred. If the treatment or recovery technologies selected are not a permanent solution, an explanation must be published.

- The least-favored remedial actions are those that include “offsite transport and disposal of hazardous substances or contaminated materials without treatment where practicable treatment technologies are available” (Section 121(b)).
- The selected remedy must comply with or attain the level of any “standard, requirement, criteria, or limitation under any federal environmental law or any promulgated standard, requirement, criteria, or limitation under a State environmental or facility siting law that is more stringent than any federal standard, requirement, criteria, or limitation” (Section 121(d)(2)(A)).

3.2 Site-Specific Remedial Action Objectives

The level of soil contamination, presence of debris, the associated potential exposure routes, and the protection of groundwater are considered when developing site-specific RAOs for protecting human health and the environment (CH2M HILL, 2013). The future protection of environmental resources and the means of minimizing long-term disruption to existing facility operations are also considered. Current and potential future land use at Site 1 is reasonably anticipated to remain industrial. Land use controls (LUCs) will be implemented to prevent unrestricted land use within the LUC area, which is estimated to be the area contained within the Site 1 boundary. Therefore the site-specific RAOs for Site 1 are:

- Prevent or minimize direct contact with soil COCs at concentrations above background that pose unacceptable risks to potential industrial workers, trespasser/visitor adolescents, construction workers, residents, and ecological receptors
- Prevent or minimize overland migration of COCs at concentrations above background to the North Branch Potomac River
- Prevent or minimize migration of COCs at concentrations above background from soil to groundwater, in order to enhance the ability of the groundwater remedy to restore the aquifers to beneficial use
- Render area free of surficial debris (including partially exposed debris) from within the boundaries of the OABG
- Control erosion and riverbank scour to prevent subsurface debris from becoming exposed

The potential future scenarios for hypothetical residential receptors were evaluated in the RI but are not included in the remedial alternatives because the reasonably anticipated future land use for the site is anticipated to be industrial, an active RCRA unit in the ABG, and presence of a floodplain and extensive subsurface debris in the OABG. Land-use restrictions will be addressed as part of the LUCs within each remedial alternative.

The remedial alternatives screened and evaluated for this FS report were considered with respect to the goal of meeting the site-specific RAOs and meeting the standards defined by the federal and State ARARs. If the ARARs do not address a particular situation, remedial actions may be based on the TBC criteria or guidelines. ARARs and TBC criteria are described below.

3.3 ARARS and TBC Criteria

As required by Section 121 of CERCLA, remedial actions at Site 1 carried out under Section 104 or secured under Section 106 must attain the standards of control for hazardous substances, pollutants, or contaminants specified by the ARARs of federal and West Virginia environmental laws and state facility-siting laws, unless waivers are obtained. Additionally, certain requirements for actions taken within the waterway are governed by Maryland regulations and they have also been included as ARARs. According to EPA guidance, remedial actions also must be based on non-promulgated TBC criteria or guidelines if the ARARs do not address a particular situation.

EPA distinguishes ARARs as being either applicable to a site or relevant and appropriate to a site. The distinctions are critical to understanding the constraints imposed on remedial alternatives by environmental regulations. ARARs can include any promulgated standard, requirement, criterion, or limitation under a state environmental or facility-siting law that is more stringent than the associated federal standard, requirement, criterion, or limitation.

The definitions of ARARs below are from federal guidance (EPA, 1988 and 1989). Both the applicable requirements and the relevant and appropriate requirements pertain to a site, to the extent practicable.

Applicable requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limits promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, removal action, or other circumstance, as defined in the NCP, 40 CFR 300.5. For a requirement to be applicable, the remedial action or the circumstances at the site must satisfy all the jurisdictional prerequisites of that requirement. Only those state standards identified by a state in a timely manner and that are more stringent than federal requirements may be considered as applicable requirements.

Relevant and appropriate requirements are standards, standards of control, and other substantive environmental protection requirements, criteria, or limits promulgated under federal or state law that (although not applicable to a hazardous substance, a pollutant, a contaminant, a remedial action, or other circumstances at a CERCLA site) address problems or situations sufficiently similar to those encountered at the CERCLA site so that their use is well-suited to the particular site. Relevant and appropriate requirements also are defined in the NCP (40 CFR 300.5). Only those state standards identified by a state in a timely manner and that are more stringent than federal requirements may be considered as relevant and appropriate requirements.

In addition to ARARs, proposed rules, guidance documents, directives, and similar documents that might affect a CERCLA remedial action are TBC documents. If the ARARs do not address a particular situation, remedial actions should be based on the TBC criteria or guidelines.

Three classifications of requirements are defined by EPA in the ARAR determination process—chemical-specific, location-specific, and action-specific:

- *Chemical-specific* ARARs are health- or risk-management-based numbers or methodologies that result in numerical values for a given media that would meet the NCP “threshold criterion” of overall protection of human health and the environment. These requirements generally set protective cleanup concentrations for the COCs in the designated media, or set safe concentrations of discharge for removal activity. Chemical-specific ARARs may be concentration-based cleanup goals or may provide the basis for calculating such levels. In cases where no chemical-specific ARAR exists, chemical advisories may be used to develop remedial objectives. Federal and state chemical-specific ARARs that may affect the development and conceptual arrangement of Site 1 soil remedial alternatives are summarized in Appendix B.
- *Location-specific* ARARs restrict activities based on the geographic location of the site or characteristics of the surrounding environments. These ARARs are intended to limit activities within designated areas. Location-specific ARARs may include restrictions on actions within floodplains, near locations of known endangered species, or on protected waterways. Federal and state location-specific ARARs that have been reviewed relative to the Site 1 soil remedial alternatives are summarized in Appendix B.
- *Action-specific* ARARs are requirements that define acceptable procedures related specifically to the type of activity being performed. These ARARs control or restrict hazardous substance- or pollutant-related activities. These controls are considered when specific remedial activities are planned for a site. Federal and state action-specific ARARs that may affect the development and conceptual arrangement of remedial alternatives at Site 1 are summarized in Appendix B.

3.4 Areas of Concern

For the purpose of this FS report, the lateral and vertical extent of the AOCs is based on current data and historical knowledge of the site. A 95 percent upper confidence limit (UCL) of site-wide soil concentrations within the ABG and OABG was used to estimate targeted remediation areas, identified herein as AOCs, in Site 1 soil (CH2M HILL, 2013). Eight AOCs have been identified in the ABG—AOCs 1 through 6, FDP 1, and FDP 3—as shown in Figure 3-1. Eleven AOCs have been identified in the OABG, as shown in Figure 3-2 and Figure 3-3. Figure 3-4 presents the conceptual site model for Site 1 soil, including cross-sectional areas to illustrate the assumed extent of the AOCs. As documented in the EE/CA and Action Memorandum (CH2M HILL, 2012a; CH2M HILL 2012b), an NTCRA is being conducted to address the unsaturated soil beneath FDPs 1 and 3, which are two AOCs identified in the ABG. The horizontal and vertical extent of the excavation area for FDP 1 and FDP 2 are the historical aerial boundaries of each pit and the groundwater table, respectively. However, there may be contamination left in place after the NTCRA that exceeds the established SRGs. This residual contamination will be managed in the same manner as the other ABG AOCs. The assumed vertical extent of the AOCs within the ABG is 5 feet bgs. The assumed vertical extent of the AOCs within the West OABG and East OABG is 10 feet bgs and 12 feet bgs, respectively. Table 3-1 summarizes the volume of each AOC identified in the ABG and OABG. Table 3-1 also summarizes the volume breakdown of the contaminated soil into hazardous and nonhazardous waste. For the purposes of this FS report, it was assumed that the contaminated soil deemed to be hazardous for disposal is driven by the presence of TCE greater than 10 milligrams per kilogram (mg/kg). Based on current soil data, it is assumed that 100 percent of the chemically contaminated soil in the ABG and 36 percent of the chemically contaminated soil in the OABG is non-hazardous for disposal. The remaining 64 percent of chemically contaminated soil in the OABG is assumed to be hazardous for disposal. The area where TCE concentrations are greater than 10 mg/kg are associated with OABG AOCs 2, 3, 4, 5, 6, and 7 (Figures 3-2 and 3-3). A pre-design study will be conducted to delineate more precisely the lateral and vertical extent of contamination, and to assess the characteristic nature of the contaminated soil in support the remedial design (RD) process.

Tables 3-2 and 3-3 summarize the COCs for remediation in the AOCs within the ABG and OABG, respectively, to address the historical activities and disposal that took place, minimize potential unacceptable risk to human and ecological receptors and groundwater quality, and enhance the ability of the groundwater remedy to restore the aquifer to beneficial use. Upon completion of the baseline evaluation of the 95 percent UCL of sitewide concentrations, the following constituents were eliminated from further consideration as risk drivers because the 95 percent UCL of the sitewide soil concentration was below the SRG and the maximum concentration of individual sample results were less than 5 times the SRG: ABG(1,1-dichloroethene, hexahydro-1,3,5-trinitro-1,3,5-triazine(RDX), dioxin toxicity equivalents (TEQs), manganese, mercury) and OABG (benzo(b)fluoranthene, dibenz(a,h)anthracene, TEQs, arsenic, iron, nickel, silver, zinc). Although the 95 percent UCL of the sitewide concentration of octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) and copper in the ABG and PCE, benzo(a)anthracene, benzo(a)pyrene, total PAHs – low molecular weight, and vanadium in the OABG were below the SRG, the maximum concentration of the individual results exceeded five times the SRG). Therefore, these constituents were retained as COCs. Methyl acetate was also retained as a risk driver in the OABG to get the overall 95 percent UCL concentration below the SRG.

3.4.1 OABG Debris

As discussed in Section 2.4.12 and shown in Figures 3-2 and 3-3, there are portions of OABG AOCs that are co-mingled with surface and subsurface debris. For the purpose of the FS, it was assumed that 50 percent of the co-mingled areas are chemically contaminated soil and 50 percent is debris, both of which will be taken offsite for disposal. Table 3-1 summarizes the volume breakdown between contaminated soil and subsurface debris for the AOCs identified in the ABG and OABG. Although the characteristic nature of the debris in unknown, the debris characterization indicated that asbestos-contaminated material was present in the surface and subsurface. For the purpose of the FS, it was assumed that 5 percent of the subsurface debris in the AOCs where construction debris was identified (OABG AOCs 3 and 7) will be deemed hazardous and require special handling and disposal. The volume of surface debris has been estimated as 5 times the volume removed during the 2008 OABG limited surface debris removal.

Material potentially presenting an explosive hazard (MPPEH), as defined by NOSSA Instruction 8020.15D (Naval Ordnance Safety and Security Activity [NOSSA], 2013), includes munitions debris remaining after munitions use, demilitarization, or disposal such as the ballistic rocket casings and manufacturing debris present in the surface and subsurface of the OABG, respectively. Given the presence of MPPEH in the surface and subsurface, intrusive activities that take place in the OABG will require explosive safety technical support assessments from the NOSSA and oversight from certified UXO personnel. Disturbance of these areas will also require the support of a certified asbestos abatement contractor to assess and address the presence of asbestos-containing material.

It was assumed that the chemically contaminated soil and subsurface debris will be separated, characterized, handled, and disposed appropriately. Details regarding the reuse and recycling of debris (for example, reuse of construction debris, recycling of metal, etc.) and waste management (for example, characterization, management, and disposal) will be included in the remedial action work plan. A pre-design study will be conducted to estimate more precisely the volumes of hazardous and nonhazardous waste to support the RD process.

Table 3-1
Volume Breakdowns for the ABG and OABG Areas of Concern
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Area of Concern[1]	Depth of Contaminated Soil[2] (ft)	Aerial Extent of Contaminated Soil (sf)	Volume of Contaminated Soil (CY)	Volume of Contaminated Soil Assumed to be Hazardous[6] (CY)	Volume of Contaminated Soil Assumed to be Nonhazardous (CY)
Active Burning Ground					
1	5	314.16	58.18	0	58.18
2	5	1,055.13	195.39	0	195.39
3	5	1,425.38	263.96	0	263.96
4	5	1,425.38	263.96	0	263.96
5	5	1,425.38	263.96	0	263.96
6	5	1,425.38	263.96	0	263.96
FDP 1	14	0.00	0.00	0	0.00
FDP 3	14	0.00	0.00	0	0.00
TOTALS		*7,070.81*	*1,309.41*	*0*	*1,309.41*

Area of Concern	Depth of Contaminated Soil[2] (ft)	Aerial Extent of Contaminated Soil (sf)	Depth of Subsurface Debris[3] (ft)	Aerial Extent of Subsurface Debris (sf)	Volume of Contaminated Soil[4] (CY)	Volume of Subsurface Debris[5] (CY)	Volume of Contaminated Soil Assumed to be Hazardous[5] (CY)	Volume of Contaminated Soil Assumed to be Nonhazardous (CY)	Volume of Subsurface Debris Assumed to be Hazardous[6] (CY)	Volume of Subsurface Debris Assumed to be Nonhazardous (CY)
Outside Active Burning Ground										
1	10	314.16	6	59.32	109.76	6.59	0.00	109.76	0.00	6.59
2	10	1,441.88	12	1,441.88	267.01	267.01	56.46	210.56	0.00	267.01
3	10	9,187.91	3	260.62	2,981.82	421.11	1663.09	1318.73	21.06	400.06
			6	489.55						
			9	2,113.44						
4	10	698.54	3	259.30	244.31	14.41	100.32	143.99	0.00	14.41
5	10	3,213.45	3	109.38	1,184.09	6.08	674.03	510.06	0.00	6.08
6	12	6,582.59	0	0.00	2,925.60	0.00	1396.69	1528.91	0.00	0.00
7	12	18,576.15	6	4,156.89	6,513.18	1,742.89	5376.81	1136.36	87.14	1655.75
			9	7,686.09						
8	12	314.16	12	164.70	103.03	36.60	0.00	103.03	0.00	36.60
9	10	314.16	6	70.55	67.92	48.44	0.00	67.92	0.00	48.44
			9	243.61						
10	10	314.16	6	270.46	78.21	38.14	0.00	78.21	0.00	38.14
			12	43.70						
11	10	314.16	6	314.16	81.45	34.91	0.00	81.45	0.00	34.91
TOTALS		*41,271.32*	*na*	*17,683.65*	*14,556.37*	*2,616.18*	*9267.41*	*5288.97*	*108.20*	*2507.98*

Notes:

[1] The volume of contaminated soil in the FDPs consists of the residual contamination left in place after their removal. For the purposes of this FS, the uncertainty of residual contamination cannot be estimated and is assumed 0 CY.

[2] For the purpose of this FS, the vertical extent of the AOCs is based on current data and historical knowledge of the site. The assumed vertical extent of the AOCs within the ABG is 5 feet bgs. The assumed vertical extent of the AOCs within the West OABG and East OABG is 10 feet bgs and 12 feet bgs, respectively.

[3] Taken from the Debris Characterization Technical Memorandum (CH2M HILL, 2008). Although the depth of debris may extent as deep as 12 feet, the assumed excavation depth in the West OABG is 10 feet bgs. Therefore, the debris volume and contaminated volume was calculated using 10 foot depth.

[4] For the purpose of the FS, it is assumed that 50 percent of the comingled areas is chemically contaminated soil and 50 percent is debris.

[5] Soil is assumed to be hazardous in nature where TCE concentrations exceed 10 mg/kg.

[6] Although the characteristic nature of the debris is unknown, it is known that there is asbestos contaminated material associated with construction debris present in the subsurface. For the purposes of the FS, it is assumed that 5% of construction debris identified in OABG AOCs 3 and 7 will be deemed hazardous.

ABG - active burning ground
AOC - area of concern
CY - cubic yards
FDP - former disposal pit
ft - feet
na - not applicable
sf - square feet

Table 3-2
ABG Risk Drivers
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Area of Concern	Association	Sample Location(s) Slated for Removal	Sample Depth(s) (feet bgs)	Primary Risk Driver(s)[2] (SRG ratio)	Notes[3]
FDP 1	Former Disposal Pit 1	BG-008/008S/009/038	0 - 1	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
			3 - 5	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
			12.5 - 13.5	TCE (263)	Secondary risk driver is PCE (1.50).
		AS01-SB60	0 - 0.5	TCE (11.3)	There are no secondary risk drivers.
			1 - 3	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
			3 - 5	na	Sample is being removed because subsurface sample is being removed. Secondary risk driver is TCE (1.06).
			5 - 7	TCE (5.81)	There are no secondary risk drivers.
FDP 3	Former Disposal Pit 3	BG-004/004S/005/039	0 - 1	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
			3 - 4	TCE (1,000)	Secondary risk driver is PCE (3.36).
			3 - 5	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
			10 - 11	TCE (475)	There are no secondary risk drivers.
		AS01-SB62	0 - 0.5	TCE (6.88)	There are no secondary risk drivers.
			1 - 3	TCE (156)	There are no secondary risk drivers.
			3 - 5	TCE (75.0)	There are no secondary risk drivers.
			5 - 7	TCE (42.5)	There are no secondary risk drivers.
			7 - 8	TCE (39.4)	There are no secondary risk drivers.
1	na	AS01-SB02	0 - 1	Lead (10.8)	There are no secondary risk drivers.
2	Former Earthen Burn Pad 7	AS01-SB64	0 - 0.5	Perchlorate (36.8) HMX (5.10)	Secondary risk driver is nitroglycerin (1.51).
			7.5 - 8	Perchlorate (22.1)	Secondary risk driver is TCE (3.75).
3	Former Earthen Burn Pad 4	AS01-SB67	0 - 0.5	Copper (7.19)	There are no secondary risk drivers.
4	Former Earthen Burn Pad 3	AS01 - SB68	0 - 0.5	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
			1.5 - 2	TCE (5.88) Lead (5.71)	There are no secondary risk drivers.
5	Former Earthen Burn Pad 2	AS01-SB69	0 - 0.5	TCE (8.75)	Secondary risk driver is PCE (1.91).
			1 - 1.5	TCE (75.0) PCE (26.4)	There are no secondary risk drivers.
6	Former Earthen Burn Pad 1	AS01-SB70	0 - 0.5	na	Sample is being removed because subsurface sample is being removed. Secondary risk driver is lead (2.42).
			2.5 - 3	TCE (11.3) Lead (11.0)	There are no secondary risk drivers.

Notes:

Information summarized from Table 10 in the 95% UCL Technical Memorandum (CH2M HILL, 2013)

( ) - SRG ratio

bgs - below ground surface

na - not applicable

[1] Areas of concern generated based on the industrial scenario for human health risk and residential scenario for ecological risk. In addition, the AOCs are based on unrestricted use associated with soil-to-groundwater leaching.

[2] Primary risk driver is defined as COC that exceeds 95% UCL SRG and 5 times the SRG, or does not exceed the 95% UCL SRG but exceeds 5 times the SRG (i.e., samples with red flags in Table 10).

[3] Secondary risk driver is defined as COC that exceeds the 95% UCL SRG, but does not exceed the 5 times SRG ratio (i.e. is at a ratio between 1.0 and 5.0)

Table 3-3
OABG Risk Drivers
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Area of Concern[1]	Sample Location(s) Slated for Removal	Sample Depth(s) (feet bgs)	Primary Risk Driver(s)[2] (SRG ratio)	Notes[3]
1	AS01-SB48	0 - 1	Methyl Acetate (2.83)	Technically, there are no primary risk drivers requiring the removal of this sample; however, the sample was removed to get the overall 95% UCL methyl acetate concentration below the SRG, which is 300 mg/kg for surface soil. Prior to sample removal, the 95% UCL methyl acetate concentration was 347 mg/kg, and after the removal it decreased to 18.2 mg/kg. Secondary risk driver is TCE (4.44).
2	AS01-TP05	5 - 6	TCE (9.38)	There are no secondary risk drivers.
	BG -150	2 - 3	TCE (21.0)	There are no secondary risk drivers.
3	AS01-TP09	4 - 5	Vanadium (5.75)	There are no secondary risk drivers.
	AS01-SB57	0 - 1	Benzo(a)pyrene (5.71)	Secondary risk drivers are total PAHs - HMW (4.58), copper (2.04), chromium (1.39), and lead (1.20).
	BG-139	2 - 3	TCE (5.43)	There are no secondary risk drivers.
	BG-158	2 - 3	TCE (56.8) 1,2-DCE (total) (15.8)	There are no secondary risk drivers.
	BG-113	0 - 1	TCE (9.88)	There are no secondary risk drivers.
		2 - 3	TCE (116)	There are no secondary risk drivers.
	AS01-SB26	0 - 1	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
		1 - 2	TCE (30.9)	There are no secondary risk drivers.
	BG-138	2 - 3	TCE (173)	Secondary risk driver is 1,2-DCE (total) (2.89).
	AB01-SB49	0 - 1	Methyl Acetate (1.50)	Technically, there are no primary risk drivers requiring the removal of this sample; however, the sample was removed to get the overall 95% UCL methyl acetate concentration below the SRG, which is 300 mg/kg for surface soil. Prior to sample removal, the 95% UCL methyl acetate concentration was 347 mg/kg, and after the removal it decreased to 18.2 mg/kg. Secondary risk drivers are total PAHs - HMW (4.02) and TCE (1.22).
	BG-134	2 - 3	TCE (284) 1,2-DCE (5.11)	There are no secondary risk drivers.
	AS01-SB39	0 - 1	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
		1 - 2	TCE (19.8)	There are no secondary risk drivers.
	BG-098/098S	0 - 1	TCE (33.3)	There are no secondary risk drivers.
	AS01-TP13	9 - 10	TCE (8.52)	There are no secondary risk drivers.
4	AS01-TP14	3 - 4	TCE (32.1)	There are no secondary risk drivers.
		9 - 10	TCE (114)	There are no secondary risk drivers.
5	AS01-TP15	9 - 10	TCE (13.6)	There are no secondary risk drivers.
	BG-167/168	2 - 3	TCE (63.0)	There are no secondary risk drivers.
	BG-166	2 - 3	TCE (114)	There are no secondary risk drivers.
6	BG-146	2 - 3	TCE (24.7)	There are no secondary risk drivers.
	BG-102/102S	0 - 1	na	Sample is being removed because subsurface sample is being removed. Secondary risk driver is TCE (1.10).
		1 - 2	TCE (30.9)	There are no secondary risk drivers.
	BG-147	2 - 3	TCE (65.4)	Secondary risk driver is 1,2-DCE (total) (1.87).
	BG-148	2 - 3	TCE (79.0) 1,2-DCE (total) (53.3)	There are no secondary risk drivers.
	BG-110/110S	0 - 1	TCE (32.1) 1,2-DCE (total) (35.6)	Secondary risk driver is cobalt (1.06).
		2 - 3	TCE (42.0) 1,2-DCE (total) (60.0)	There are no secondary risk drivers.
	BG-149	2 - 3	TCE (7.90)	There are no secondary risk drivers.
7	AS01-SB73	0 - 1	TCE (27.2)	There are no secondary risk drivers.
		1.5 - 2	TCE (210)	There are no secondary risk drivers.
	AS01-SB52	0 - 1	TCE (7.90)	Secondary risk driver is mercury (1.30)
	AS01-TP28	3 - 4	TCE (32.1)	Secondary risk driver is copper (2.36)
		9 - 10	TCE (14.8)	There are no secondary risk drivers.
	B1-004	0.5 - 1	Lead (15.4)	Secondary risk drivers are cadmium (3.28), copper (3.08), and chromium (2.34).
	AS01-SB21	0 - 1	TCE (101)	Secondary risk drivers are mercury (2.92), copper (2.08), lead (1.43), and chromium (1.01).
	B1-C	0 - 1	Lead (6.36)	Secondary risk driver is mercury (1.30).

Table 3-3
OABG Risk Drivers
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Area of Concern[1]	Sample Location(s) Slated for Removal	Sample Depth(s) (feet bgs)	Primary Risk Driver(s)[2] (SRG ratio)	Notes[3]
7 (continued)	AS01-SB30	0 - 1	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
		1 - 2	TCE (16.0)	Secondary risk drivers are lead (3.24), mercury (2.80), chromium (2.62), and copper (1.31).
	AS01-SB53	0 - 1	TCE (44.4)	Secondary risk drivers are lead (1.67), chromium (1.49), and copper (1.12).
	AS01-TP29	3 - 4	TCE (86.4)	Secondary risk driver is mercury (3.04).
		9 - 10	TCE (568)	There are no secondary risk drivers.
	B1-011	0.5 - 1	Copper (5.49)	Secondary risk drivers are mercury (2.86), cadmium (2.69), chromium (2.34), and lead (1.26).
		1 - 2	Cadmium (8.85) Lead (8.51)	Secondary risk drivers are copper (3.38), chromium (2.41), and mercury (1.55).
	AS01-SB22	0 - 1	TCE (80.2) Chromium (5.25)	Secondary risk drivers are copper (4.27) and mercury (1.55).
	BG-174	2 - 3	TCE (444)	There are no secondary risk drivers.
	AS01-TP36	3 - 4	TCE (284)	There are no secondary risk drivers.
		9 - 10	TCE (901)	There are no secondary risk drivers.
	AS01-SB72	0 - 1	RDX (60.8) HMX (53.0) Mercury (35.0) Cadmium (21.4) Chromium (7.47) TCE (5.43) Methyl acetate (5.33)	Secondary risk drivers are nitroglycerin (1.35) and lead (1.04).
		4.5 - 5	TCE (95.1) Nitroglycerin (81.1) RDX (15.0) PCE(10.0)	Secondary risk driver is cadmium (1.10).
8	AS01-SB74	0 - 1	na	Sample is being removed because subsurface sample is being removed. There are no risk drivers in this interval.
		4 - 5	Copper (53.8) Chromium (6.60)	Secondary risk drivers are lead (1.10) and cobalt (1.03).
9	B2-007	1 - 2	Copper (8.50)	Secondary risk driver is mercury (1.68).
10	AS01-SB34	0 - 1	na	Sample is being removed because subsurface sample is being removed. Secondary risk driver is cobalt (1.15).
		1 - 2	Copper (3.95)	Technically, there are no primary risk drivers requiring the removal of this sample; however, the sample was removed to get the overall 95% UCL copper concentration below the SRG, which is 253 mg/kg for surface soil. Prior to sample removal, the 95% UCL copper concentration was 257 mg/kg, and after the removal it decreased to 247 mg/kg. There are no secondary risk drivers.
11	AS01-SB25	0 - 1	na	Sample is being removed because subsurface sample is being removed. Secondary risk driver is cobalt (1.06).
		1 - 2	Total PAHs - HMW (27.3) Benzo(a)pyrene (26.2) Total PAHs - LMW (8.28) Benzo(a)anthracene (6.59)	There are no secondary risk drivers.

Notes:
Information summarized from Table 14 in the 95% UCL Technical Memorandum (CH2M HILL, 2013)
( ) - SRG ratio
bgs - below ground surface
na - not applicable
[1] Areas of concern generated based on the industrial scenario for human health risk and residential scenario for ecological risk. In addition, the AOCs are based on unrestricted use associated with soil-to-groundwater leaching.
[2] Primary risk driver is defined as COC that exceeds 95% UCL SRG and 5 times the SRG, or does not exceed the 95% UCL SRG but exceeds 5 times the SRG (i.e., samples with red flags in Table 14).
[3] Secondary risk driver is defined as COC that exceeds the 95% UCL SRG, but does not exceed the 5 times SRG ratio (i.e. is at a ratio between 1.0 and 5.0).

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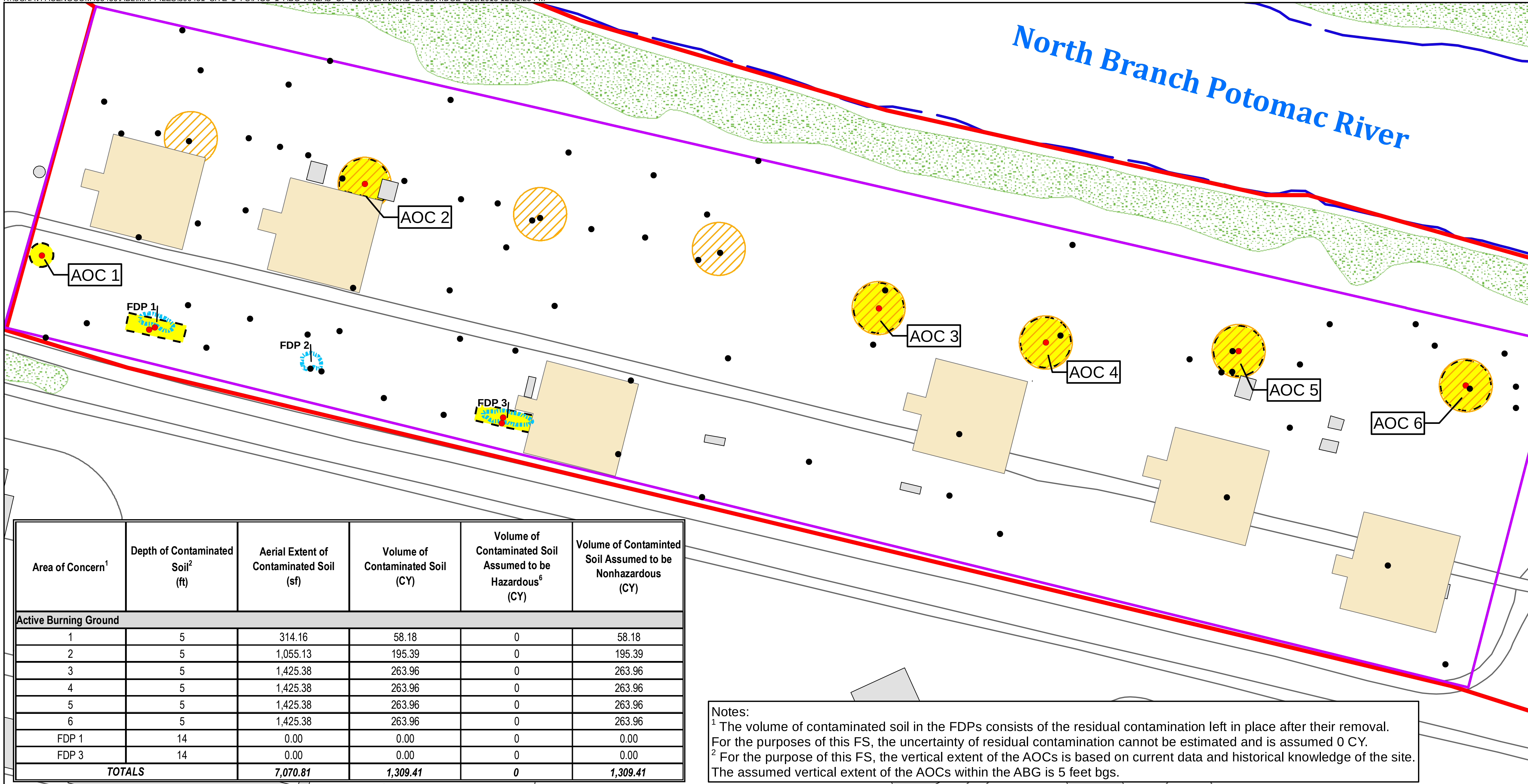

Area of Concern[1]	Depth of Contaminated Soil[2] (ft)	Aerial Extent of Contaminated Soil (sf)	Volume of Contaminated Soil (CY)	Volume of Contaminated Soil Assumed to be Hazardous[6] (CY)	Volume of Contaminted Soil Assumed to be Nonhazardous (CY)
Active Burning Ground					
1	5	314.16	58.18	0	58.18
2	5	1,055.13	195.39	0	195.39
3	5	1,425.38	263.96	0	263.96
4	5	1,425.38	263.96	0	263.96
5	5	1,425.38	263.96	0	263.96
6	5	1,425.38	263.96	0	263.96
FDP 1	14	0.00	0.00	0	0.00
FDP 3	14	0.00	0.00	0	0.00
TOTALS		*7,070.81*	*1,309.41*	*0*	*1,309.41*

Notes:
[1] The volume of contaminated soil in the FDPs consists of the residual contamination left in place after their removal. For the purposes of this FS, the uncertainty of residual contamination cannot be estimated and is assumed 0 CY.
[2] For the purpose of this FS, the vertical extent of the AOCs is based on current data and historical knowledge of the site. The assumed vertical extent of the AOCs within the ABG is 5 feet bgs.

Legend

- Sample not removed to achieve 95% UCL industrial SRG
- Sample removed to achieve 95% UCL industrial SRG
- Roads
- Area of Concern (AOC)
- Former Disposal Pits (FDP)
- Former Earthen Burn Pads
- Burn Pads
- Vegetation
- Structures
- Active Burning Ground
- Site 1 Boundary

Note:
Dashed line is inferred boundary.

N

0 40 80 Feet

1 inch = 80 feet

Figure 3-1
ABG Areas of Concern
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

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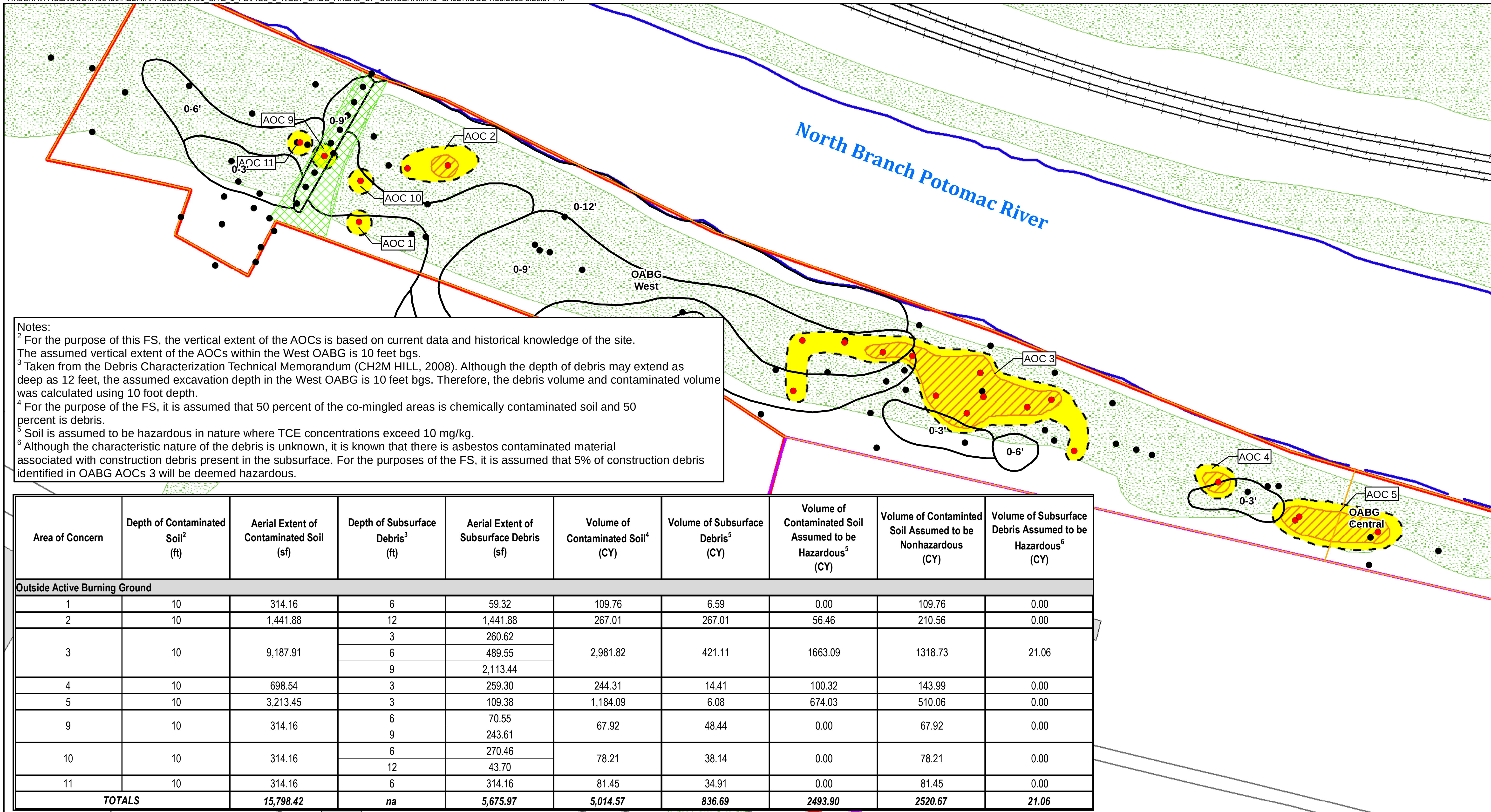

Notes:
2 For the purpose of this FS, the vertical extent of the AOCs is based on current data and historical knowledge of the site. The assumed vertical extent of the AOCs within the West OABG is 10 feet bgs.
3 Taken from the Debris Characterization Technical Memorandum (CH2M HILL, 2008). Although the depth of debris may extend as deep as 12 feet, the assumed excavation depth in the West OABG is 10 feet bgs. Therefore, the debris volume and contaminated volume was calculated using 10 foot depth.
4 For the purpose of the FS, it is assumed that 50 percent of the co-mingled areas is chemically contaminated soil and 50 percent is debris.
5 Soil is assumed to be hazardous in nature where TCE concentrations exceed 10 mg/kg.
6 Although the characteristic nature of the debris is unknown, it is known that there is asbestos contaminated material associated with construction debris present in the subsurface. For the purposes of the FS, it is assumed that 5% of construction debris identified in OABG AOCs 3 will be deemed hazardous.

Area of Concern	Depth of Contaminated Soil[2] (ft)	Aerial Extent of Contaminated Soil (sf)	Depth of Subsurface Debris[3] (ft)	Aerial Extent of Subsurface Debris (sf)	Volume of Contaminated Soil[4] (CY)	Volume of Subsurface Debris[5] (CY)	Volume of Contaminated Soil Assumed to be Hazardous[5] (CY)	Volume of Contaminted Soil Assumed to be Nonhazardous (CY)	Volume of Subsurface Debris Assumed to be Hazardous[6] (CY)
Outside Active Burning Ground									
1	10	314.16	6	59.32	109.76	6.59	0.00	109.76	0.00
2	10	1,441.88	12	1,441.88	267.01	267.01	56.46	210.56	0.00
3	10	9,187.91	3	260.62	2,981.82	421.11	1663.09	1318.73	21.06
			6	489.55					
			9	2,113.44					
4	10	698.54	3	259.30	244.31	14.41	100.32	143.99	0.00
5	10	3,213.45	3	109.38	1,184.09	6.08	674.03	510.06	0.00
9	10	314.16	6	70.55	67.92	48.44	0.00	67.92	0.00
			9	243.61					
10	10	314.16	6	270.46	78.21	38.14	0.00	78.21	0.00
			12	43.70					
11	10	314.16	6	314.16	81.45	34.91	0.00	81.45	0.00
TOTALS		***15,798.42***	***na***	***5,675.97***	***5,014.57***	***836.69***	***2493.90***	***2520.67***	***21.06***

Legend
- Sample not removed to achieve 95% UCL industrial SRG
- Sample removed to achieve 95% UCL industrial SRG
- Roads
- Railroads
- Vegetation
- Active Burning Ground
- Site 1 Boundary
- Area where TCE concentrations are greater or equal to 10 mg/kg and is assumed to be characteristically hazardous
- Area of Concern (AOC)
- Approximate ditch removal/regrading
- Subsurface debris area (CH2M HILL, 2008b)
- OABG Region

Note: Dashed line is inferred boundary

N

0 37.5 75 Feet

1 inch = 75 feet

Figure 3-2
West OABG Areas of Concern
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

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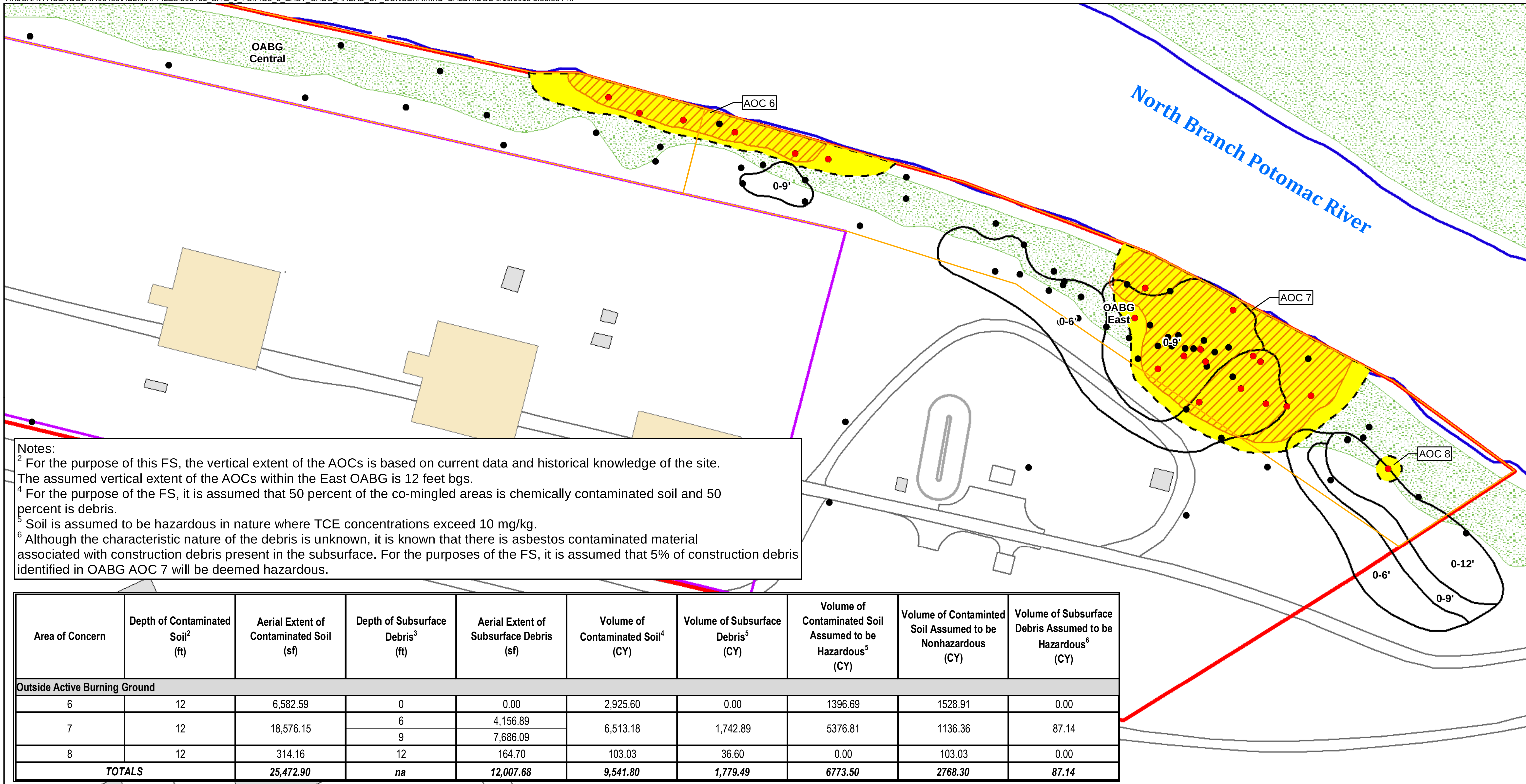

Notes:
[2] For the purpose of this FS, the vertical extent of the AOCs is based on current data and historical knowledge of the site. The assumed vertical extent of the AOCs within the East OABG is 12 feet bgs.
[4] For the purpose of the FS, it is assumed that 50 percent of the co-mingled areas is chemically contaminated soil and 50 percent is debris.
[5] Soil is assumed to be hazardous in nature where TCE concentrations exceed 10 mg/kg.
[6] Although the characteristic nature of the debris is unknown, it is known that there is asbestos contaminated material associated with construction debris present in the subsurface. For the purposes of the FS, it is assumed that 5% of construction debris identified in OABG AOC 7 will be deemed hazardous.

Area of Concern	Depth of Contaminated Soil[2] (ft)	Aerial Extent of Contaminated Soil (sf)	Depth of Subsurface Debris[3] (ft)	Aerial Extent of Subsurface Debris (sf)	Volume of Contaminated Soil[4] (CY)	Volume of Subsurface Debris[5] (CY)	Volume of Contaminated Soil Assumed to be Hazardous[5] (CY)	Volume of Contaminted Soil Assumed to be Nonhazardous (CY)	Volume of Subsurface Debris Assumed to be Hazardous[6] (CY)
Outside Active Burning Ground									
6	12	6,582.59	0	0.00	2,925.60	0.00	1396.69	1528.91	0.00
7	12	18,576.15	6	4,156.89	6,513.18	1,742.89	5376.81	1136.36	87.14
			9	7,686.09					
8	12	314.16	12	164.70	103.03	36.60	0.00	103.03	0.00
TOTALS		***25,472.90***	***na***	***12,007.68***	***9,541.80***	***1,779.49***	***6773.50***	***2768.30***	***87.14***

Legend
- Sample not removed to achieve 95% UCL industrial SRG
- Sample removed to achieve 95% UCL industrial SRG
- Roads
- Burn Pads
- Vegetation
- Structures
- Active Burning Ground
- Site 1 Boundary
- Area where TCE concentrations are greater or equal to 10 mg/kg and is assumed to be characteristically hazardous
- Area of Concern (AOC)
- Subsurface debris area (CH2M HILL, 2008b)
- OABG Region

Note: Dashed line is inferred boundary

N

0 37.5 75 Feet
1 inch = 75 feet

Figure 3-3
East OABG Areas of Concern
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

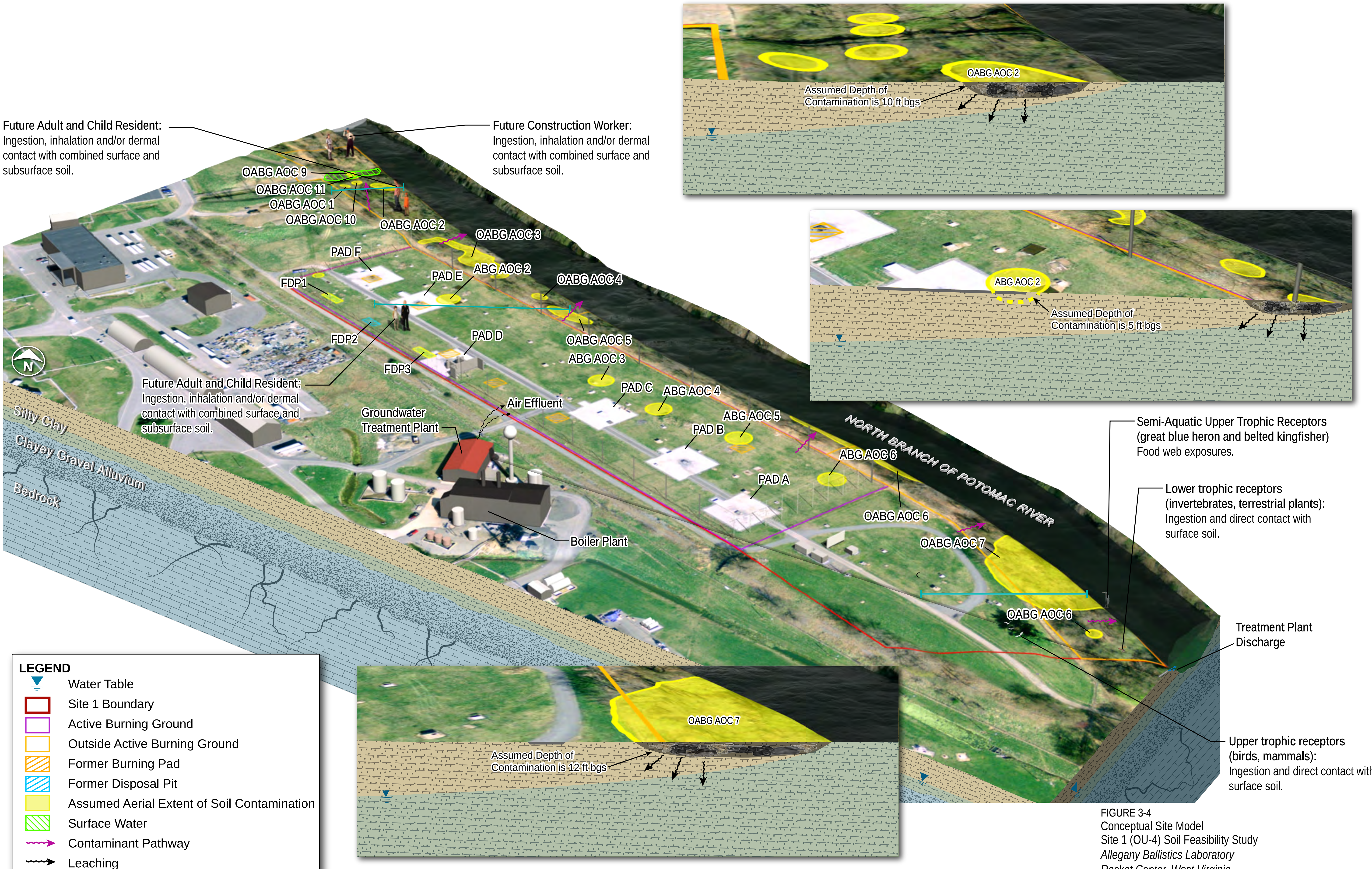

FIGURE 3-4
Conceptual Site Model
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory
Rocket Center, West Virginia

SECTION 4

Screening of Remedial Technologies and Development of Remedial Alternatives

This section discusses the general response actions that were developed to address the RAOs outlined in the previous section. Potential remedial technologies and specific process options, which underwent a primary screening to evaluate their suitability as part of a remedial alternative, are identified and described for each response action.

4.1 Identification and Screening of General Response Actions

General response actions are broad classes of responses or remedies developed to meet the site-specific RAOs. Each action is intended to address specific constituents and the possible migration pathways and exposure routes in the soil. Although an action may be capable of meeting an objective, combinations of actions may be more cost-effective in meeting the objectives. Table 4-1 presents the general response actions and the preliminary screening of various technologies within each general response action.

The general response actions listed below have been identified as being potentially applicable for ABL Site 1 soil:

- No action (as a basis of comparison for other general response actions)
- LUCs
- Long-term management (LTMgt)
- *In situ* treatment
- *Ex situ* treatment
- Containment
- Excavation

No Action—As required by the NCP, the no-action response is included in the evaluation as a baseline for evaluating the remedial alternatives.

LUCs—The LUCs response action is a category of alternatives that can be used alone or as part of another response action. For the soil COCs at Site 1, this category includes activities such as restricting land use through administrative and/or legal controls.

LTMgt—The LTMgt phase is required at sites where contaminants remain in place above levels that allow for unlimited use. This response action includes a 5-year review cycle to ensure the remedial alternative components continue to meet the site-specific RAOs. It may also include, as needed, more frequent site inspections, repairs or maintenance, or LUC inspections.

***In situ* treatment–**Actions that are taken on contaminants in place to reduce their toxicity, mobility, and/or volume. For the soil COCs at Site 1, this category includes biological treatment and chemical/physical treatment.

***Ex situ* treatment–**Actions that are taken on contaminants once they are removed to reduce their toxicity, mobility, and/or volume. For the soil COCs at Site 1, this category includes biological treatment and chemical/physical treatment.

Containment— Containment response actions are technologies that provide physical barriers to exposure to or migration of contaminants; they also reduce infiltration and prevent or minimize contaminants leaching to groundwater. For the soil COCs at Site 1, this category includes capping.

Excavation—Actions taken to physically remove contaminated soil or solid waste from the site and dispose of the material in an offsite permitted disposal facility, or reuse onsite. For the soil COCs at Site 1, this category includes excavation and both onsite and offsite disposal.

4.2 Identification and Screening of Remedial Technologies and Process Options

The next step in the FS process is to identify remedial technologies and process options for each general response action. Remedial technologies are general categories of technologies, such as administrative and legal controls; biological, chemical, and physical treatment; capping; and excavation and disposal. Process options are specific processes within each technology type. For example, the *in situ* chemical/physical treatment remedial technology includes process options such as electrokinetic separation, thermal, soil vapor extraction/air sparging, soil flushing, solidification/stabilization, and chemical reduction with zero-valent iron. The remedial technologies and process options that potentially apply to Site 1 soil were qualitatively screened based on their effectiveness, implementability, and relative cost in meeting the ARARs and achieving the RAOs.

The effectiveness criterion focused on the ability of a technology to reduce toxicity, mobility, or volume through treatment; minimize residual risks; afford long-term protection; comply with ARARs; minimize short-term impacts; and achieve protection within a reasonable timeframe. The NCP instructs that “alternatives providing significantly less effectiveness than other, more promising alternatives may be eliminated. Alternatives that do not provide adequate protection of human health and the environment shall be eliminated from further consideration” (40 CFR 300.430(e)(7)(i)).

The evaluation of implementability focuses on technical feasibility, availability, and administrative feasibility. Technical feasibility refers to the ability to build and reliably operate/maintain a technology. Administrative feasibility refers to the ability to gain approval from regulatory and other agencies and to obtain the necessary materials and skilled labor. The NCP instructs that alternatives “that are technically or administratively infeasible or that would require equipment, specialists, or facilities that are not available within a reasonable period of time may be eliminated from further consideration” (40 CFR 300.430(e)(7)(ii)).

The evaluation of cost addresses direct and indirect capital costs and annual operation and maintenance (O&M) costs. The cost range is presented quantitatively when possible. Otherwise, qualitative descriptions of low, moderate, and high cost are used. The costs are estimated from a review of the literature, vendor quotations, and data prepared for other studies. The NCP instructs “costs that are grossly excessive compared to the overall effectiveness of alternatives may be considered as one of several factors used to eliminate alternatives. Alternatives providing effectiveness and implementability similar to that of another alternative by employing a similar method of treatment or engineering control, but at greater cost, may be eliminated” (40 CFR 300.430(e)(7)(iii)).

In addition, consideration of sustainable practices is becoming increasingly important throughout the remediation community, and this emphasis is now being reflected in policy and guidance. In September 2010, EPA issued *Superfund Green Remediation Strategy,* which is a program management tool describing current EPA plans to maximize the environmental outcome of Superfund projects through reduction of negative environmental effects that might occur during site assessment, site remediation, or non-time critical removal actions. The Naval Facilities Engineering Command prepared a *Sustainable Environmental Remediation Fact Sheet* (2009), which outlines the Navy’s guidance on incorporating sustainable remediation into the environmental remediation process.

Table 4-1 presents the screening of the technologies and process options, as well as the rationale for why a technology or option was eliminated or retained for further considerations. The technologies and process options that passed this initial screening are:

- No Action – The no-action response is required by the NCP and was retained to provide a basis for comparison with the other actions. No attempt is made to satisfy the RAOs, and no remedial measures are implemented under this alternative.
- LUCs – Land use measures were retained because they can control, minimize, or prevent human exposures to the contaminated soil. They can be used alone as a remedial action or coupled with other options to form a remedial alternative.

- *Ex Situ* thermal desorption – Results in the reduction of toxicity, mobility, and volume through treatment upon removal. *Ex situ* treatment options were evaluated to treat soil containing hazardous levels of COCs (assumed to be driven by TCE) to nonhazardous levels before offsite disposal. This option would require soil screening in the OABG to remove MPPEH and non-munition debris before treatment.

  A qualitative screening of three *ex situ* remedial technologies was conducted to evaluate treatment of excavated soils contaminated with TCE and to select the most appropriate *ex situ* technology to carry forward in this feasibility study. The three technologies considered were treatment with zero-valent iron, soil vapor extraction, and thermal treatment. The technologies were qualitatively compared on the basis of relative effectiveness, relative capital costs, and relative implementability. Given sufficient time, all of the evaluated technologies would likely be effective. Consequently, the evaluation focused on implementability and relative capital costs.

  Because all the proposed *ex situ* technologies include mechanical soil removal and handling after treatment, those costs are expected to be similar for each technology and therefore were not considered in the screening. Similarly, costs for components such as engineering design, permitting, procurement and subcontract management, services during implementation, and project management were not included. The technical approaches for the options were developed on a conceptual basis. The approach and requirements for the selected remedy will be considered in more detail as part of the remedial design process.

- As indicated in Table 4-1, *ex situ* thermal treatment is expected to be the most cost-effective technology for addressing TCE in the excavated soil. It is also the most easily implemented and requires the least site space to implement. Thermal treatment also has the highest potential to achieve SRGs, possibly making the treated soil suitable for re-use, thereby lowering overall remediation costs. Excavation and Offsite Disposal – Although it may or may not involve a treatment component, this process option was retained because it would remove the contaminated media from the site, protect human health and the environment, and minimize soil-to-groundwater leaching. Excavation may reduce the long-term requirements of monitoring or other periodic activities typically required if contaminated media are left in place. In addition, excavation does not generate interference with the future RCRA closure requirements in the ABG. This option would require soil screening on the OABG to remove MPPEH and non-munition debris before disposal. Debris is not anticipated to be encountered in the ABG; however, if encountered, it would be managed in the same manner as described for OABG.

4.3 Development of Remedial Alternatives

The next step in the FS process is to group process options that remain after the primary evaluation into remedial alternatives that meet the ARARs and achieve the RAOs defined in Section 3. The RAOs focus on preventing contact with soil containing COCs above the SRGs, minimizing overland migration of COCs to the North Branch Potomac River, and preventing/minimizing migration of COCs from soil to groundwater. The remedial technologies and process options that passed the initial screening process discussed in this section were assembled into remedial alternatives for the ABG and OABG soil. The remedial alternatives for both the OABG and ABG, which are developed and evaluated within this FS and selected during development of the Proposed Remedial Action Plan and ROD, will be the final action under CERCLA. However, for the ABG, the selected remedial alternative is not intended to be the final action under RCRA. The RCRA closure requirements, as outlined in the RCRA Subpart X permit, will be met upon closure of the RCRA unit. The following remedial alternatives were identified for the ABG soil:

- **Alternative 1—No Action**: This alternative is required by NCP as a baseline. Alternative 1 involves no action for the ABG.

- **Alternative 2 – Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt:** This alternative involves excavation of the areas comprising AOCs 1 through 6 within the ABG, backfill to original grade, offsite disposal, LUCs, and LTMgt. In addition, residual contamination left in place after the NTCRA of FDP 1 and FDP 3 will be managed in the same manner as the AOCs (excavation, backfill, offsite disposal, LUCs and LTMgt).

The following remedial alternatives were identified for the OABG soil:

- **Alternative 1—No Action**: This alternative is required by NCP as a baseline. Alternative 1 involves no action for the OABG.
- **Alternative 2—Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt**: This alternative involves removal of surficial debris, excavation of the areas comprising AOCs 1 through 11 within the OABG, anomaly avoidance, debris handling and management, reconfiguration of the Western Drainage Ditch, offsite disposal, sustainable bank restoration, LUCs, and LTMgt.
- **Alternative 3 – Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt:** This alternative comprises the same components as Alternative 2, with an additional component of treatment via *ex situ* thermal desorption of waste soil deemed hazardous to levels deemed non-hazardous before offsite disposal.

Table 4-1
Preliminary Screening of Remedial Technologies
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

General Response Action	Remedial Action or Technology	Process Options	Description	Effectiveness	Implementability	Relative Cost	Meets ARARs and Achieves RAOs?		Screening Action		Screening Comments
							ARARs	RAOs	Retain	Reject	
No Action	No Action	No Action	No action.	Does not protect human health, the environment, or prevent soil-to-groundwater leaching. Does not reduce COC migration, contaminant concentrations, or satisfy the RAOs for Site 1.	Easily implemented.	Not Applicable	No	No	X		Retain as baseline alternative per NCP.
Land Use Controls (LUCs)	Administrative and/or legal controls	Governmental controls; proprietary controls; enforcement and permit tools with LUC components; and informational devices.	•Governmental controls may include zoning restrictions, ordinances, statutes, building permits, or other provisions that restrict land or resource use at a site. •Proprietary controls may include easements that restrict use and restrictive covenants. •Enforcement and permit tools with LUC components may include administrative orders, permits, FFAs, and consent decrees. •Informational controls may include state registries of contaminated sites, notices in deeds, tracking systems, and consumption advisories.	Effectiveness depends on continued future implementation regardless of property use or ownership. LUCs are meant to supplement engineering controls and may be a necessary component of the completed remedy. Does not minimize soil-to-groundwater leaching, reduce COC migration and contaminant concentrations, or remove surface debris. Partially satisfies RAOs by preventing human exposure to soil COCs.	Easily implemented. A general LUC plan has already been developed for ABL that lists access restrictions and procedures for implementing restrictions.	Low capital, low O&M.	No	Partial	X		LUCs have been retained and may be used in conjunction with other remedial technologies to meet the ARARs and achieve the RAOs. Appropriate LUCs for Site 1 will be determined during the remedial design and documented in an LUC RD.
Long-term Management (LTMgt)	Administrative component	Enforcement with LTMgt components.	Following achievement of the remedy complete milestone, the component may be required to monitor long-term protectiveness of the remedy during the LTM phase. The LTMgt phase is required when the remedial action objectives do not allow unrestricted use of the property. Actions during this phase may involve monitoring site conditions, implementing and managing LUCs, and performing 5-year reviews.	Effectiveness depends on continued future implementation. LTMgt is meant to ensure continued protection as designed once a site achieves remedy complete.	Easily implemented. LTMgt should be used until no further environmental restoration response actions are appropriate or anticipated.	Cost varies on duration and complexity of the LTMgt program established after remedy complete.	No	Partial	X		LTMgt has been retained and may be used in conjunction with other remedial technologies to meet the ARARs and achieve the RAOs. Appropriate LTMgt for Site 1 will be determined during the remedial design and documented in an LUC RD.
In Situ Treatment	Biological Treatment	Enhanced Bioremediation	The biodegradation process is a treatment mechanism for COCs that optimizes biological degradation of organic contaminants or immobilization of inorganics by amending the subsurface with substrate. Anaerobic degradation is enhanced by the addition of carbon source materials such as vegetable oil, lactate and others. Aerobic degradation is enhanced by the addition of nutrients and oxygen. Substrate can be delivered using direct push techniques or permanent injection wells. Enhanced bioremediation can also be implemented in conjunction with other technologies such as thermal, chemical reduction, and SVE/air sparging.	Bioremediation alternatives have been proven to remediate saturated soils with low level residual organic contamination as well as source zones. Bioremediation cannot degrade inorganics, explosives, dioxins, or perchlorate, which are COCs at Site 1. Anaerobic bioremediation is more effective than aerobic remediation when treating highly chlorinated VOCs, such as PCE and TCE. This technology is typically associated with treatment of saturated soils and/or groundwater, not unsaturated soils being evaluated in this FS.	The success of *in situ* delivery relies on saturated soil and/or groundwater to support substrate delivery. The Site 1 soils under consideration are within the unsaturated and vadose zone. Delivery methods can be reduced by preferential pathways and/or low permeability soils which decrease the contact between injected fluids and target COCs throughout the contaminated zone. This is especially of concern in the OABG where subsurface debris is present. High metal concentrations can inhibit the ability of microorganisms to breakdown the contaminants. Efficient treatment of dioxins is unlikely.	Low capital, low O&M ($20 to $80 per cubic yard)	No	No		X	Multitude of COCs at Site 1, including high concentration of metals, are not treated by enhanced bioremediation technology. The presence of low permeability soils at Site 1 would prevent proper distribution of the substrate and nutrients to achieve successful implementation of this technology. The high density of buried waste and debris in the OABG, prevent *in situ* technology from being a viable option along the shoreline. Technology relies on water for delivery and it not conducive to unsaturated soils at Site 1. The addition of amendment(s) to the site will be evaluated as part of the site-wide optimization effort but will not be included as part of this action.
		Phytoremediation	Organics are stabilized or degraded by plants through processes such as enhanced rhizosphere degradation, hydraulic control, phytodegradation and phytovolatilization.	Plants can uptake metals and reduce metal loading in soils and reduce infiltration; certain species may be effective for dissolved phase VOCs. Not effective in treating explosives, dioxins or perchlorate. Not effective for deeper soil contamination in the OABG.	Easily implementable; however, implementability in the ABG may be reduced due to active RCRA unit present and plantings may not be allowed.	Low to moderate capital, low to moderate O&M.	No	No		X	Phytoremediation is not a feasible for all Site 1 COCs or for deeper soil contamination present in the OABG. Height and planting restrictions are of a concern for safety reasons in both the ABG and OABG. In addition, the long-term maintenance and offsite disposal of plants containing heavy metals would raise the long-term O&M costs of this technology.

Table 4-1
Preliminary Screening of Remedial Technologies
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

General Response Action	Remedial Action or Technology	Process Options	Description	Effectiveness	Implementability	Relative Cost	Meets ARARs and Achieves RAOs?		Screening Action		Screening Comments
							ARARs	RAOs	Retain	Reject	
In Situ Treatment (Continued)	Chemical/Physical Treatment	Electrokinetic Separation	A low-intensity current is applied through the soil between ceramic electrodes that are divided into cathode array and an anode array. The current mobilizes charged species, causing ions and water to move toward the electrodes. Metal ions, ammonium ions, and positively charged organic compounds move toward the cathode. Negatively charge ions such as chloride, cyanide, fluoride, nitrate, and negatively charged organic compounds move toward the anode.	Not effective if moisture content is less than 10 percent and at sites where there is a high content of buried metal waste, since metallic waste can induce variability in the electrical conductivity of the soil.	Electrokinetics is not applicable to low permeability soils. This technology works well with contaminants such as heavy metals, anions, and polar organics, in soil, mud, sludge and marine dredging. This option may not be effective for dioxins.	Moderate to high capital, moderate to high O&M. ($153 per cubic yard)	No	No		X	This technology option is not viable for Site 1 due to the low permeability soils. This technology does not have the potential to treat all COCs. In addition, the amount of buried debris within the OABG make this remedial alternative unfeasible in this area.
		Thermal	Application of heating *in situ* to volatilize, hydrolyze, and/or pyrolyze contaminants. Typically implemented in conjunction with a soil vapor recovery system to collect volatilized contaminants. Methods of *in situ* heating include: resistivity (electrodes), conductive/convective (ISTD), radio frequency/electromagnetic, steam injection, and hot air injection.	*In situ* thermal treatment using ERH or ISTD technology is a proven method for treatment of chlorinated VOCs, often achieving >99% removal, even in low permeability clay and silt. ERH is more sensitive to soil moisture content, and buried metal debris can cause "short-circuiting". Higher molecular weight PAH compounds typically require treatment using ISTD, which can achieve temperatures above 100 degrees C. Radio frequency heating is not commonly applied. Steam/hot air injection is not used for treatment of higher molecular weight PAH compounds. Thermal treatment s not effective for inorganics, explosives, or perchlorate. The technology must be used in conjunction with a soil vapor recovery system.	Readily implemented in open areas. Soils with high organic carbon content may slow removal of some VOCs. Debris or other large objects buried in the OABG can cause obstructed drilling of closely spaced electrodes/heaters. Installing vapor recovery wells using the ERH method or installing an *in situ* thermal desorption system may be challenging on the slopes present at portions of the OABG. There is a potential for horizontal wells in this area.	Moderate to high Capital, Low O&M. ($80-$140 per cubic yard)	No	No		X	*In situ* heating technology is not viable at Site 1 because the thermal treatment does not treat all of the Site 1 COCs, including inorganic, explosives, and perchlorate. In addition, the buried debris and topographical grades across the OABG towards the river makes it challenging to implement *in situ* heating technologies in this area.
		SVE/Air Sparging	Air is injected into soils to maximize contaminant volatilization to the vapor phase. Vapors are then extracted and treated.	Proven for *in situ* stripping of chlorinated VOCs and biodegradation of some lower molecular weight SVOCs. This technology is applicable to only volatile compounds with a Henry's law constant greater than 0.01 or a vapor pressure greater than 0.5 mm Hg.	Low permeability formations generally require (expensive) soil fracturing and/or high vacuum/pressure application. Not effective for treatment of high molecular weight PAH compounds. Buried waste in the OABG would affect the operation of the system and can induce short circuiting.	Moderate to high capital, moderate to high O&M. ($75 to $250 per cubic yard)	No	No		X	Not effective for all Site 1 COCs, including higher molecular weight SVOCs, inorganics, dioxins, and perchlorate. The soils that need treatment at Site 1 are mainly silts and clays with low permeability which can substantially increase the operation cost of the system. Additionally, the amount of waste buried at the OABG may not allow a good distribution of injected air and can cause short circuiting when operating this system.
		Soil Flushing	Water or water containing an additive is injected into the ground to increase contaminant solubility. Contaminants leach out into the ground water which is then extracted or treated.	This alternative works better for inorganic contaminants although it can be used for VOCs and SVOCs COCs. Not effective for dioxins and perchlorate.	This technology works best in coarse grained soils. Tight formations like silts and clays present at Site 1, which have lower soil permeability than coarse grained soils, are difficult to treat, and may cause remediation time and costs to significantly increase. Surfactants used as additives can alter soil porosity and reduce contaminant mobility. The pump and treat system currently operating at Site 1 would be viable as an extraction method. Increased concern regarding the implementability along the river front and potential leaching into the river prior to collection.	Low to moderate capital, low to moderate O&M. ($18-$49 per cubic yard)	No	No		X	Does not treat all Site 1 COCs. Due to the subsurface geology at Site 1, soil flushing has been rejected. Site characteristics indicate that this technology is not feasible since the contaminated soils are mainly composed of silts and clays. The buried waste in the OABG would prevent good distribution of surfactants/reagents in this area. Furthermore, the implementation of soil flushing would require the existing groundwater treatment plant to likely undergo additional upgrades.

Table 4-1
Preliminary Screening of Remedial Technologies
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

General Response Action	Remedial Action or Technology	Process Options	Description	Effectiveness	Implementability	Relative Cost	Meets ARARs and Achieves RAOs?		Screening Action		Screening Comments
							ARARs	RAOs	Retain	Reject	
In Situ Treatment (Continued)	Chemical/Physical Treatment (Continued)	Solidification/Stabilization	Solidification/stabilization is the process by which contaminants are physically enclosed within a stabilized matrix; thereby, changing their chemical properties and reducing their mobility. Solidification/ Stabilization using Portland cement: Can be effective for inorganic compounds, but is not effective for organic compounds.	This technology has limited effectiveness against VOCs and SVOCs. Would require use in conjunction with other technologies.	Implementable; however, the presence of debris in the OABG may cause operational challenges.	Solidification/ Stabilization with Portland Cement: Moderate. $50 to $80 per cubic meter ($40 to $60 per cubic yard)	No	No		X	This technology is eliminated as an *in situ* treatment because of its low effectiveness for treatment of areas of concern with VOCs, the primary risk driver in the majority of the ABG and OABG areas of concern. In addition, the amount of buried debris within the OABG make this *in situ* remedial technology unfeasible in this area.
		Chemical Reduction with Zero-Valent Iron (ZVI)	ZVI (iron powder or solid metal iron) is introduced to the subsurface to promote reducing conditions in order to transform or remove contaminants in soil and groundwater. Iron provides the electron source for the reaction to occur. Microscale and nanoscale ZVI particles offer greater surface area and reactivity than granular iron. A slurry of ZVI can be distributed to the subsurface using a variety of carrier fluids, including water, vegetable oil, or nitrogen gas (for nanoscale ZVI). The slurry can be delivered using direct push techniques, pneumatic fracturing, or *in situ* soil mixing.	ZVI treatment has successful in treating a wide range of environmental contaminants. ZVI is most widely known to treat chlorinated constituents, including most ethenes, some ethanes, some methanes, propanes and some benzenes. However, more research is being performed for other VOCs, SVOCs, dioxins, explosives, and perchlorate. This technology can also be implemented in conjunction with other technologies such as bioremediation, thermal, and SVE/air sparging. This technology is typically associated with treatment of saturated soils and/or groundwater, not unsaturated soils being evaluated in this FS.	Implementation for the vadose zone may be water intensive because water is required to facilitate the chemical reaction. The design of the remedy would take into account the critical elements such as moisture requirements, reaction kinetics, and diffusion to treat the entire target treatment zone. Because of the subsurface heterogeneity at Site 1, soil mixing would be a more advantageous delivery method than the injection method; however, the presence of the active RCRA unit in the ABG and the debris material in the OABG would eliminate the use of *in situ* soil mixing in this area. (See ex situ chemical reduction for additional details)	Moderate to high capital cost, low O&M. ($173 to $286 per cubic yard for nanoscale ZVI)	Yes	Yes		X	Because of the active RCRA unit in the ABG and the debris present in the OABG, in situ chemical reduction via ZVI soil mixing is not viable for the ABG of OABG. Direct push techniques may be viable in the ABG; however, this technology would require significant amount of water to facilitate the chemical reaction in the unsaturated soils in the ABG. This technology relies on water for delivery and it not conducive to unsaturated soils at Site 1. The addition of amendment(s) to the site will be evaluated as part of the site-wide optimization effort but will not be included as part of this action.
Ex Situ Treatment	Biological Treatment	Composting	Contaminated soil would be placed in windrows and amended with wood chips, hay, manure to provide porosity and a balance for carbon and nitrogen to promote thermophilic microbial activity. Daily turning of compost mixture and maintaining the appropriate moisture level is necessary to maximize degradation efficiency.	This process has been proven effective in treating organic contaminants, and is capable of reducing concentrations of explosives such as RDX and HMX.	This process might require off-gas control for VOCs and SVOCs. The volume of material to be treated increases substantially since the contaminated soils have to be mixed with amending material. Implementability of this remedial alternative is highly contingent to the amount of space available at the site. The implementability within the OABG would require screening of soils to remove the debris prior to composting.	Moderate to High capital, low O&M. ($249 to $321 per cubic yard)[1]	No	No		X	*Ex situ* treatment options are being evaluated to treat soil containing hazardous levels of COCs (assumed to be driven by TCE) to nonhazardous levels prior to offsite disposal. The volume of material to be treated is likely too large for this option to be feasible. In addition, there is limited space for treatment of the soils using composting after excavation of the site. The technology only treats limited Site 1 COCs. The technology is also a medium to long-term remedy which would require more than a year of daily composting and monitoring to be feasible. This increases the O&M costs as well.

Table 4-1
Preliminary Screening of Remedial Technologies
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

General Response Action	Remedial Action or Technology	Process Options	Description	Effectiveness	Implementability	Relative Cost	Meets ARARs and Achieves RAOs?		Screening Action		Screening Comments
							ARARs	RAOs	Retain	Reject	
Ex Situ Treatment (continued)	Biological Treatment (continued)	Landfarming	Contaminated material is applied into lined beds and periodically turned over or tilled to aerate the waste.	Technology is effective for chlorinated solvents such as TCE; however, the more chlorinated the compound, the more difficult it is to degrade. Inorganic contaminants will not be degraded. Volatile contaminants, including TCE, must be pre-treated or require an air permit to address air pollution. Conditions affecting biological degradation of contaminants (e.g., temperature, rain fall) are largely uncontrolled, which increases the time to complete remediation.	A large amount of space is required to implement this technology. Assuming a 1-foot lift, it will require 250,000 square feet of open space to implement landfarming for the hazardous waste from the OABG. The space at Site 1 is limited. This treatment would require soil screening to remove debris prior to treatment.	Low capital, low O&M ($75 per cubic yard)[1]	Yes	Yes		X	Ex situ treatment options are being evaluated to treat soil containing hazardous levels of COCs (assumed to be driven by TCE) to nonhazardous levels prior to offsite disposal. The volume of material to be treated is likely too large for this option to be feasible. In addition, there is limited space for treatment of the soils using landfarming after excavation of the site. The technology only treats limited Site 1 COCs. Although effective, implementable, and would achieve ARARs and RAOs, thermal desorption was found to require less space and less time than landfarming. The technology is also a medium to long-term remedy which would require a longer timeframe (unknown without pilot study) and monitoring to be feasible. This increases the O&M costs as well.
	Chemical / Physical Treatment	Incineration	High temperatures usually in the range of 870 to 1,200 C are used to volatilize and combust organic wastes in the presence of oxygen.	This technology is highly effective in remediating the VOCs, explosives, and dioxins but it not effective for the metals. Treatment is highly energy intensive.	Treatment might generate a residue which may require further treatment such as stabilization.	High Capital, Moderate to High O&M. ($695 to $1,063 cubic yard)[1]	Yes	Yes		X	*Ex situ* treatment options are being evaluated to treat soil containing hazardous levels of COCs (assumed to be driven by TCE) to nonhazardous levels prior to offsite disposal. Although effective, implementable, and would achieve ARARs and RAOs, thermal desorption was found to be more cost effective and less energy intensive than incineration. This energy intensive treatment technology is cost prohibitive and would require an air permit for the incinerator. The technology would be need to be used in combination with additional technologies such as stabilization to address the inorganics if needed.
		Thermal Desorption	Heat is applied to the soils so that water and other organics are volatilized. The volatilized water and organics are then treated. The operational temperature for this equipment ranges between 90 and 320 C for the low thermal unit and between 320 and 560 C for the high thermal unit.	Technology is effective as an *ex situ* treatment of hazardous concentrations of TCE. Effective for VOCs, SVOCs, and PAHs. Not effective in treating inorganics, dioxins, or perchlorate. The amount of heat delivered to the contaminated soils would not jeopardize soil ability to support future biological activity.	Easily implemented and expected to take less than 4 months to achieve concentrations of TCE to be disposed at non-hazardous landfill. Minimal space is required for thermal equipment. This treatment would require soil screening to remove debris prior to treatment. Off-gases require an air pollution control system to remove particulates and neutralize and remove acid gases (HCL, NOx and SOx). Treatment might generate a residue which may require further treatment such as stabilization.	Moderate capital, low O&M ($75-$252 per cubic yard;)[1]	Yes	Yes	X		*Ex situ* treatment options are being evaluated to treat soil containing hazardous levels of COCs (assumed to be driven by TCE) to nonhazardous levels prior to offsite disposal. Compared to ex situ chemical reduction via ZVI and ex situ SVE/air sparging technologies because given sufficient time, all three technologies would be effective. Although this technology is not viable as an *in situ* treatment, the technology is viable as an *ex situ* for the treatment of VOCs in excavated hazardous waste from the OABG. Would be used in conjunction with other technologies to treat remaining COCs if necessary.

Table 4-1
Preliminary Screening of Remedial Technologies
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

General Response Action	Remedial Action or Technology	Process Options	Description	Effectiveness	Implementability	Relative Cost	Meets ARARs and Achieves RAOs?		Screening Action		Screening Comments
							ARARs	RAOs	Retain	Reject	
Ex Situ Treatment (continued)	Chemical / Physical Treatment (continued)	SVE/Air Sparging	Air is injected into soils to maximize contaminant volatilization to the vapor phase. Vapors are then extracted and treated.	Technology is effective as an ex situ treatment of hazardous concentrations of TCE. Because the technology is ex situ, the effects of the subsurface geology would not affect the remedy of implementability as in the in situ technology. Effective for chlorinated VOCs and biodegradation of some lower molecular weight SVOCs. This technology is applicable to only volatile compounds with a Henry's law constant greater than 0.01 or a vapor pressure greater than 0.5 mm Hg.	Easily implemented and expected to take at least 8 months to achieve concentrations of TCE to be disposed at non-hazardous landfill. Large amount of space, estimated to be 1.2 acres, is required to store reactors and equipment. This treatment would require soil screening to remove debris prior to treatment.	Moderate capital, moderate O&M ($75 to $200 per cubic yard)	Yes	Yes		X	*Ex situ* treatment options are being evaluated to treat soil containing hazardous levels of COCs (assumed to be driven by TCE) to nonhazardous levels prior to offsite disposal. Compared to ex situ thermal desorption and ex situ chemical reduction via ZVI technologies because given sufficient time, all three technologies would be effective. Although effective, implementable, and would achieve ARARs and RAOs, thermal desorption was found to require less space and less time than SVE. Although this technology is not viable as an *in situ* treatment, the technology is viable as an *ex situ* for the treatment of VOCs in excavated hazardous waste from the OABG. Would be used in conjunction with other technologies to treat remaining COCs if necessary.
		Solidification/Stabilization	Solidification/stabilization is the process by which contaminants are physically enclosed within a stabilized matrix; thereby, changing their chemical properties and reducing their mobility. Solidification/ Stabilization using Portland cement: Can be effective for inorganic compounds, but is not effective for organic compounds.	This technology has limited effectiveness against VOCs and SVOCs. Would require use in conjunction with other technologies.	Implementable. Due to the large volume of soil requiring solidification and/or stabilization, implementing this technology would require ample amounts of space.	Solidification/ Stabilization with Portland Cement: Moderate. $50 to $80 per cubic meter ($40 to $60 per cubic yard)	No	Yes		X	Ex situ treatment options are being evaluated to treat soil containing hazardous levels of COCs (assumed to be driven by TCE) to nonhazardous levels prior to offsite disposal. Although this technology may be used to treat the inorganics within the hazardous waste prior to offside disposal, this technology was not retained because it does not address TCE, which is assumed to be the primary risk driver in the OABG. May be used in conjunction with other technology to treat remaining COCs if necessary.
		Chemical Reduction with Zero-Valent Iron (ZVI)	ZVI (iron powder or solid metal iron) is introduced to the excavated subsurface material to promote reducing conditions in order to transform or remove contaminants. Iron provides the electron source for the reaction to occur. Microscale and nanoscale ZVI particles offer greater surface area and reactivity than granular iron. A slurry of ZVI can be distributed via *ex situ* soil mixing techniques onsite.	Technology is effective as an ex situ treatment of hazardous concentrations of TCE. Because the technology is ex situ, the effects on the groundwater extraction system would not affect the remedy of implementability as in the in situ technology. ZVI treatment has successful in treating a wide range of environmental contaminants. ZVI is most widely known to treat chlorinated constituents, including most ethenes, some ethanes, some methanes, propanes and some benzenes. However, more research is being performed for other VOCs, SVOCs, dioxins, explosives, and perchlorate. Not effective for metals.	Easily implemented and expected to take at least 5 months to achieve concentrations of TCE to be disposed at non-hazardous landfill. Large amount of space, estimated to be 1.5 acres, is required to store reactors and equipment. This treatment would require soil screening to remove debris prior to treatment.	Moderate capital, moderate O&M ($75 to $250 per cubic yard)	Yes	Yes		X	*Ex situ* treatment options are being evaluated to treat soil containing hazardous levels of COCs (assumed to be driven by TCE) to nonhazardous levels prior to offsite disposal. Compared to ex situ thermal desorption and ex situ SVE/air sparging technologies because given sufficient time, all three technologies would be effective. Although effective, implementable, and would achieve ARARs and RAOs, thermal desorption was found to require less space and less time than ZVI. Although this technology is not viable as an *in situ* treatment, the technology is viable as an *ex situ* for the treatment of VOCs in excavated hazardous waste from the OABG. Would be used in conjunction with other technologies to treat remaining COCs if necessary.

Table 4-1
Preliminary Screening of Remedial Technologies
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

General Response Action	Remedial Action or Technology	Process Options	Description	Effectiveness	Implementability	Relative Cost	Meets ARARs and Achieves RAOs?		Screening Action		Screening Comments
							ARARs	RAOs	Retain	Reject	
Containment	Capping	Soil Cover	The design of the soil cover is site-specific and depends on the intended functions of the system. Soil cover consists of 2 feet of compacted soil material.	This alternative would minimize surface exposure to the contaminated soils. This would offer minimal water infiltration and reduction of soil-to-groundwater leaching from the top down. Although containment is a presumptive remedy for waste-in-place, the contaminated soil and leaching to groundwater is the primary driver for remedial action at Site 1. Soil-to-groundwater leaching caused by the groundwater levels rising into the unsaturated zone during flood events would not be reduced. Given the high levels of contamination present in the OABG, installation of a soil cover while leaving this waste in place reduces the effectiveness of this technology. Furthermore, a soil cover prevents residual soil contamination from being flushed out and captured by the groundwater treatment system. Long term liability in a landfill is a potential concern.	A soil cover in the ABG may interfere with the future RCRA closure requirements. The RCRA permit will be triggered as an ARAR for all containment alternatives, which may lead to more stringent cleanup requirements. There is potential to modify the RCRA air permits with change in ground and/or burn pad elevations. Additional storm water management must also be installed. These actions reduce the implementability of this technology. Flooding and damage to soil covers located along floodplains generate implementability concerns in the OABG. A highly engineered system must be developed to account for seasonal flooding and protection of the cover. Surface debris and debris along riverfront would have to be removed prior to the implementation of this alternative.	Low to moderate capital cost and low to moderate O&M. ($175k/acre)	No	No		X	A soil cover does not sufficiently address the soil-to-groundwater leaching concerns. Treatment or removal of contaminant concentrations greater than the protectiveness factor of the soil cover itself would be needed to sufficiently protect groundwater and meet ARARs. Complicating issues include the triggering of partial closure with installation of a cap, consideration of CERCLA remedial action requirements with respect to RCRA permit requirements (i.e., future land use), potential duplication of effort with RCRA/CERCLA remedial actions, and removal of a soil cover upon RCRA unit closure. The negative effects on current OABG habitat and North Branch Potomac River reduces the viability of a soil cover.
		RCRA D or RCRA C cap (hydraulic conductivity performance of $1x10^{-7}$ or $1x10^{-5}$ cm/s)	The design of cap is site-specific and depends on the intended functions of the system. The most critical components are the barrier layer and the drainage layer. The barrier layer can be low-permeability soil (clay) and/or geosynthetic clay liners (GCLs). A flexible geomembrane liner is placed on top of the barrier layer. Soils used as barrier materials generally are clays that are compacted to a hydraulic conductivity no greater than 1×10^{-5} cm/sec.	This alternative would minimize surface exposure to the contaminated soils. This would prevent maximum water infiltration and soil-to-groundwater leaching from the top down. Although containment is a presumptive remedy for waste-in-place, the contaminated soil and leaching to groundwater is the primary driver for remedial action at Site 1. Soil-to-groundwater leaching caused by the groundwater levels rising into the unsaturated zone during flood events would not be reduced. Given the high levels of contamination present in the OABG, installation of a soil cover while leaving this waste in place reduces the effectiveness of this technology. Furthermore, a soil cover prevents residual soil contamination from being flushed out and captured by the groundwater treatment system.	A RCRA cap in the ABG may interfere with the future RCRA closure requirements. The RCRA permit would be triggered as an ARAR for all containment alternatives, which may lead to more stringent cleanup requirements. There is potential to modify the RCRA air permits with change in ground and/or burn pad elevations. Additional storm water management must also be installed. These actions reduce the implementability of this technology. Flooding and damage to RCRA caps located along floodplains generate implementability concerns in the OABG. A highly engineered system must be developed to account for seasonal flooding and protection of the cover. Surface debris and debris along riverfront would have to be removed prior to the implementation of this alternative.	Low to moderate capital cost and low to moderate O&M. ($175k/acre for RCRA Subtitle D and $225k/acre for RCRA Subtitle C)[1]	No	No		X	A RCRA cap along a water way does not sufficiently address the soil-to-groundwater leaching concerns from beneath the cap caused by fluctuations in the groundwater table. Treatment or removal of contaminant concentrations greater than the protectiveness factor of the RCRA cap itself would be needed to sufficiently protect groundwater and meet ARARs. Complicating issues include the triggering of partial closure with installation of a cap, consideration of CERCLA remedial action requirements with respect to RCRA permit requirements (i.e., future land use), potential duplication of effort with RCRA/CERCLA remedial actions, and removal of a RCRA cap upon RCRA unit closure. The negative effects on current OABG habitat and North Branch Potomac River reduces the viability of a RCRA cap.
		Modified Soil Cover	A modified soil cover is an enhanced soil cover that reduces soil moisture via plant uptake and evapotranspiration. Plant cover also limits soil erosion.	Same as Soil Cover. Although anticipated to be minimal, phytoremediation as the secondary component may provide treatment mechanisms for both organic and inorganic COCs.	Same as Soil Cover.	Comparable to the cost for installing a RCRA D cap or equivalent	No	No		X	Same as Soil Cover. Increased vegetation would enhance the ecological habitat along the river front.

Table 4-1
Preliminary Screening of Remedial Technologies
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Allegany Ballistics Laboratory, Rocket Center, WV

General Response Action	Remedial Action or Technology	Process Options	Description	Effectiveness	Implementability	Relative Cost	Meets ARARs and Achieves RAOs?		Screening Action		Screening Comments
							ARARs	RAOs	Retain	Reject	
Excavation	Excavation and Disposal	Excavation and Onsite Disposal	Contaminated material is removed, treated onsite, and reused as backfill.	Treatment is contingent on the effectiveness of the alternative chosen. The wide array of COCs at Site 1 make choosing an effective treatment train challenging. Effective if the impacted volume is fully delineated. Horizontal and vertical delineation of the areas of concern in both the ABG and OABG is being performed under a separate UFP-SAP effort.	Excavation is a readily implementable technology and involves standard construction practices. Implementability may require stormwater management, river management, erosion and sediment control, and sustainable bank restoration plans. Surface debris and debris along riverfront would have to be removed prior to the implementation of this alternative. Excavation of contaminated soil in the OABG would involve mechanical screening of debris material at the OABG. Excavated materials would require on- or offsite *ex situ* treatment prior to backfilling. There are several concerns regarding the viability of *ex situ* treatment technologies that are capable of treating the COCs are Site 1 (VOCs, SVOCs, metals, explosives, perchlorate, and dioxins). Additional concerns include potential to leach metals, the capability of technologies to treat to levels deemed acceptable for backfill, generation of another waste stream from treatment, worker safety, cost-to-benefit ratio, and unknown future emerging contaminants not addressed in treatment. Furthermore, a sustainable bank restoration approach may require minimal backfill for implementation.	Moderate capital cost	No	No		X	The treatment and reuse of contaminated soil as backfill was eliminated from evaluation because of State regulations and the effectiveness and implementability concerns. All surface debris exposed along the OABG and river bank would be removed. WVDEP is not requiring the removal of subsurface debris that is not associated with contaminated soil. Excavation technology does not generate the interference with the future RCRA closure requirements. Sustainable bank restoration approach may be used to enhance ecological habitat and prevent future erosion issues. Potential to minimize backfill required.
		Excavation and Offsite Disposal	Contaminated material is removed and transported to permitted offsite treatment and disposal facilities. Material may be treated prior to offsite disposal to reduce contaminant concentrations and characteristic nature.	Is protective of protect human health, the environment, and prevents soil-to-groundwater leaching. COC migration and contaminant concentrations are reduced and RAOs are satisfied. Effective if the impacted volume is fully delineated. Horizontal and vertical delineation of the areas of concern in both the ABG and OABG is being performed under a separate UFP-SAP effort.	Excavation is a readily implementable technology and involves standard construction practices. Implementability may require stormwater management, river management, erosion and sediment control, and sustainable bank restoration plans. Surface debris and debris along riverfront would have to be removed prior to the implementation of this alternative. Excavation of contaminated soil in the OABG would involve mechanical screening of debris material at the OABG. Excavated materials may be treated ex situ prior to offsite disposal.	High capital cost ($45 to $300 per cubic yard)	Yes	Yes	X		All surface debris exposed along the OABG and river bank would be removed. WVDEP is not requiring the removal of subsurface debris that is not associated with contaminated soil. Excavation technology does not generate the interference with the future RCRA closure requirements. Sustainable bank restoration approach may be used to enhance ecological habitat and prevent future erosion issues. Potential to minimize backfill required.

Notes:
ABG - Active Burning Ground
OABG - Outside Active Burning Ground
[1] Costs obtained from www.frtr.gov
Technologies were evaluated on the assumption that TCE is the primary risk driver to be considered for treatment.

SECTION 5

Descriptions and Detailed Analysis of Remedial Alternatives

This section describes the remedial alternatives discussed in Section 4.3 in further detail. It is anticipated that CERCLA statutory 5-year reviews would be conducted under each alternative, if it were implemented, with the exception of the no-action alternative. Descriptions of the remedial alternatives, including the drawings and cost estimates presented in this section, are conceptual and are not intended to be RD submittals. The detailed cost estimate can be found in Appendix C.

5.1 Active Burning Ground Remedial Alternatives

5.1.1 Alternative 1—No Action

The no-action alternative is required by the NCP and serves as the baseline alternative. All other remedial alternatives are judged against the no-action alternative. Under this alternative, no controls or remedial technologies would be implemented.

5.1.2 Alternative 2—Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt

Alternative 2 consists of excavation and offsite disposal of the AOCs described in Section 3.5 and shown on Figure 3-1. The general remedial action components of this alternative are (Appendix C, Table C-4):

- Excavation of AOCs with Offsite Disposal
  - Excavation – Assumes each AOC will be excavated to a vertical depth of 5 feet bgs and include over excavation at a 2H:1V slope for stability and worker safety. A pre-design study will be conducted to delineate more precisely the lateral and vertical extent of contamination in support the RD process. Excavated soil is assumed to be staged in roll-offs before offsite disposal. An Erosion and Sediment Control Plan will be developed to document the details and requirements of the controls.
  - Backfill – Assumes each AOC will be backfilled to original grade with imported soil.
  - Survey/Compaction – Land survey and compaction testing are required because the AOCs are within the actively used portion of Site 1. It is assumed that backfill will be compacted to 90 percent.
  - Restoration - Providing topsoil, seeding, and mulching to restore the pre-excavation conditions found in the ABG.
  - Transportation and Disposal (T&D) - Assume disposal offsite at a non-hazardous RCRA D facility via truck. The T&D cost also assumes one investigation-derived waste sample will be collected for every 200 tons of soil excavated. The transportation cost is based on industry standard. A more-precise cost estimate will be developed during the RD when a designated landfill is chosen. Offsite disposal via rail will also be evaluated then.
- LUCs
  - LUCs will be implemented to limit the site to industrial use and ensure appropriate industrial land use is maintained to minimize the potential for human exposure to contamination.
- LTMgt
  - It is assumed that the LTMgt component for the soils includes LUC inspections. Any vegetation or erosion repairs are expected to be minimal and will be covered under the OABG LTMgt.
  - The LTMgt costs for monitoring the impact of soil remediation on groundwater will be addressed under the framework of the current groundwater LTM for OU-3.

In addition to the general components of this alternative, the detailed components of this alternative are (Appendix C, Table C-5):

- AOC 1
  - AOC 1 is not associated with a historical disposal or burn area. Therefore, the excavation is assumed to be conducted over a 10-foot radius horizontal area; approximately 58 cubic yards (yd^3) of contaminated soil and 20 yd^3 of over excavation.
  - Restoration for AOC 1 also includes cost for pavement repair because the area is along the ABG access road and may encroach on the structure.
- AOC 2
  - AOC 2 is associated with former earthen burn pad 7. Therefore, the excavation is assumed to be conducted over the horizontal extent of the former burn pad (approximately 20-foot diameter); approximately 195 yd^3 of soil contamination and 36 yd^3 of over excavation.
  - Excavation of AOC 2 will not extend below the current concrete burn pad E.
  - Includes temporary shoring along burn pad E to protect the structure during excavation.
- AOC 3
  - AOC 3 is associated with former earthen burn pad 4. Therefore, the excavation is assumed to be conducted over the horizontal extent of the former burn pad (approximately 20-foot diameter); approximately 264 yd^3 of soil contamination and 42 yd^3 of over excavation.
- AOC 4
  - AOC 4 is associated with former earthen burn pad 3. Therefore, the excavation is assumed to be conducted over the horizontal extent of the former burn pad (approximately 20-foot diameter); approximately 264 $yd^3$of soil contamination and 42 yd^3 of over excavation.
- AOC 5
  - AOC 5 is associated with former earthen burn pad 2. Therefore, the excavation is assumed to be conducted over the horizontal extent of the former burn pad (approximately 20-foot diameter); approximately 264 yd^3 of soil contamination and 42 yd^3 of over excavation.
  - Includes temporary shoring along a concrete structure (vault associated with the extraction well system) to the south of AOC 5 to protect the structure during excavation.
- AOC 6
  - AOC 6 is associated with former earthen burn pad 1. Therefore, the excavation is assumed to be conducted over the horizontal extent of the former burn pad (approximately 20-foot diameter); approximately 264 $yd^3$of soil contamination and 42 yd^3 of over excavation.
- FDP 1 and FDP 3
  - FDP 1 and FDP 3 are associated with former disposal pit 1 and former disposal pit 3, respectively. The excavation, backfill, restoration, and T&D of FDP 1 are being addressed under the forthcoming NTCRA (CH2M HILL, 2012b). However, residual contamination left in place after the NTCRA of FDP 1 and FDP 3 will be managed in the same manner as for AOCs 1 through 6 (excavation, backfill, offsite disposal, LUCs and LTMgt).
  - Because the extent of residual contamination at FDP 1 and FDP 3 are unknown until completion of the NTCRA, an excavation volume and associated cost have not been generated as part of this FS report. Residual contamination to be removed is not anticipated to alter the cost estimate to such an extent that would affect the +50 percent/-30 percent accuracy.

- Although no cost has been generated, it should be noted that soil excavated from FDP 1 and FDP 3 will be managed as listed hazardous waste (F002) because of the associated past disposal activities (disposal of spent chlorinated solvents). T&D must occur at a hazardous RCRA C facility.

For cost-estimating purposes, the construction time for Alternative 2 is 5 weeks. The operation time, for which the LTMgt is being performed, is assumed to be 30 years. LTMgt that is required for the ABG, such as erosion control repairs, are anticipated to be minimal and will be accounted for under the current groundwater LTM under OU 3. The LUCs will remain in place and be re-evaluated at RCRA closure.

Debris is not anticipated to be encountered in the ABG; however, if encountered, it would be managed in the same manner as described for OABG. In addition, it is assumed that support from explosive safety and/or certified asbestos abatement personnel will not be required as part of the activities in the ABG.

5.2 Outside Active Burning Ground Remedial Alternatives

5.2.1 Alternative 1—No Action

The no-action alternative is required by the NCP and serves as the baseline alternative. All other remedial alternatives are judged against the no-action alternative. Under this alternative, no controls or remedial technologies would be implemented.

5.2.2 Alternative 2—Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt

Alternative 2 consists of excavation and offsite disposal of the AOCs described in Section 3.5 and shown on Figures 3-2 and 3-3. As part of this alternative, surficial debris (including partially exposed debris) will be removed and properly disposed. In addition, a bank restoration plan will be developed with input from EPA, WVDEP, and the U.S. Fish and Wildlife Service incorporating sustainable practices such as a natural floodplain and reducing resource consumption. A pre-design study will be conducted to delineate more precisely the lateral and vertical extent of contamination in support the RD process, which will minimize excavation effort. In addition, a bank restoration approach has been developed that focuses on using bioengineering techniques and native vegetation for enduring, sustainable bank stabilization and erosion protection.

Remedial activities for the OABG shall be coordinated with the U.S. Army Corps of Engineers and Maryland Department of the Environment so that construction along the riverfront would be conducted in accordance with their requirements.

The general remedial action components of this alternative are (Appendix C, Table C-6):

- Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, Surface Debris Removal - Although the extent of surface debris is unknown at this time, the volume of surface debris has been estimated as five times the volume removed during the 2008 OABG limited surface debris removal. The surface debris to be removed is not anticipated to alter the cost estimate to such an extent that would affect the +50 percent/-30 percent accuracy. It should also be noted that the ballistic rocket casings are asbestos- and cadmium-contaminated and will be managed as MPPEH under the established protocols set forth by NOSSA Instruction 8020.15D.
- Excavation – Assumes each AOC in the West OABG (AOCs 1, 2, 3, 4, 5, 9, 10, and 11) will be excavated to a vertical depth of 10 feet bgs and include over excavation at a 2H:1V slope for stability and worker safety. Assumes each AOC in the East OABG (AOCs 6, 7, and 8) will be excavated to a vertical depth of 12 feet bgs and include over excavation at a 2H:1V slope for stability and worker safety. A pre-design study will be conducted to delineate more precisely the lateral and vertical extent of contamination in support the RD process. Excavated soil is assumed to be staged in roll-offs before offsite disposal.
- For the AOCs that contain subsurface debris, which was delineated in the debris characterization technical memorandum (CH2M HILL, 2008b), it is assumed that that 50 percent of the co-mingled areas is chemically contaminated soil and 50 percent is debris. Although the depth of debris may extend as deep as 12 feet, the assumed excavation depth in the West OABG is 10 feet bgs. Therefore, the debris volume and contaminated

volume was calculated using a 10-foot depth. The subsurface debris located outside of the AOC excavation areas will not be removed.

- Soil Screening – Assumes material excavated from the OABG will be screened before offsite disposal. Although not all areas are believed to contain debris, it is more cost-effective and conservative from a safety standpoint to screen all of the soil. Soil screening will ensure the removal of MPPEH and asbestos-contaminated material. If any asbestos-containing material is encountered, it will be handled in such a way as to prevent it from becoming friable. The segregation of the waste will also support the efforts to reuse and recycle material.
- Backfill – Assumes each AOC will be backfilled with imported soil. Refer to the detailed components section.
- Survey – Unlike the ABG, compaction testing is not required because the AOCs are not within the actively used portion of Site 1; however, a survey will be conducted to ensure the AOCs are backfilled to sufficient compaction to support the bank and site restoration. It is assumed that backfill will be compacted to 80 percent.
- Restoration – Site restoration, including bank stabilization, will occur across the OABG and span the West, Central, and East OABG portions. Activities encompass a sustainable bank restoration approach, with native plants installed throughout. This includes the reconfiguration/restoration of the Western Drainage Ditch. Refer to Section 5.2.2.1 for additional details.
- T&D–Assume disposal offsite to an approved facility via truck. The T&D cost assumes one investigation-derived waste sample will be collected for every 200 tons. The transportation cost was based on industry standard. A more-precise cost estimate will be developed during the RD when a designated landfill is chosen. Offsite disposal via rail will be evaluated at this time.
- T&D has been broken down into four categories: non-hazardous debris, hazardous debris, non-hazardous soil, and hazardous soil (Table 3-1). For the purposes of the FS, it was assumed that soil in the locations where concentrations of TCE exceed 10 mg/kg would be deemed characteristically hazardous for disposal. Although the characteristic nature of the debris is unknown, it is known that asbestos-contaminated material associated with construction debris is present in the subsurface. For the purposes of the FS, it was assumed that 5 percent of the construction debris identified in the OABG AOCs 3 and 7 will be deemed hazardous.
- Land Use Controls
  - LUCs will be implemented to limit the site to industrial use, ensure appropriate industrial land use is maintained to minimize the potential for human exposure to contamination, restrict intrusive activities, and appropriately maintain vegetation to achieve the RAOs. Details and requirements of the LUCs will be developed and documented in the LUC RD.
- Long-Term Management
  - Yearly Inspections/Reporting – Assumes one yearly inspection to ensure the RD components, primarily for erosion control repairs and removal/handling of any debris that surfaces, continue to meet the site-specific RAOs. This also includes the 5-year review report and necessary repairs. Details and requirements of the LTMgt will be developed and documented in the LTMgt plan to ensure that the remedy components are maintained and continue to meet the RAOs.

The detailed components of this alternative are (Appendix C, Table C-7):

- AOC 1
  - The excavation is assumed to be conducted approximately 110 yd^3 of contaminated soil, 77 yd^3 of over excavation, and 7 yd^3 of debris. It is assumed that the contaminated soil and debris generated from this area will be disposed as non-hazardous waste.
  - AOC 1 will be backfilled to original grade to support the site restoration efforts.

  - Restoration for AOC 1 also includes cost for fence repair because the excavation may encroach on the existing fence line.

- AOC 2
  - The excavation is assumed to be approximately 267 yd^3 of contaminated soil, 119 $yd^3$of over excavation, and 267 yd^3 of debris. It is assumed that a portion of the contaminated soil (56 yd^3) generated from this area will be disposed as hazardous waste. It is assumed that the debris generated from this area will be disposed as non-hazardous waste.
  - Although a portion of AOC 2 may be within the bank stabilization zone, it is assumed it will be backfilled to original grade to support the site restoration efforts.

- AOC 3
  - The excavation is assumed to be approximately 2,982 yd^3 of contaminated soil, 399 yd^3 of over excavation, and 421 yd^3 of debris. It is assumed that a portion of the contaminated soil (1,663 yd^3) and debris (21 yd^3) generated from this area will be disposed as hazardous waste.
  - The western portion of AOC 3 will be backfilled to grade and the remainder will not be backfilled. Additional backfill will be brought onsite to support the site restoration efforts, which includes a floodplain depression.
  - Restoration for AOC 3 also includes cost for fence repair because the excavation may encroach on the existing fence line.

- AOC 4
  - The excavation is assumed to be approximately 244 yd^3 of contaminated soil, 114 yd^3 of over excavation, and 14 yd^3Y of debris. It is assumed that a portion of the contaminated soil (100 yd^3) generated from this area will be disposed as hazardous waste. It is assumed that the debris generated from this area will be disposed as non-hazardous waste.
  - AOC 4 will be backfilled to original grade to support the site restoration efforts.

- AOC 5
  - The excavation is assumed to be approximately 1,184 yd^3 of contaminated soil, 251 yd^3 of over excavation, and 6 yd^3 of debris. It is assumed that a portion of the contaminated soil (674 yd^3) generated from this area will be disposed as hazardous waste. It is assumed that the debris generated from this area will be disposed as non-hazardous waste.
  - AOC 5 will be backfilled to original grade to support the site restoration efforts.
  - Restoration for AOC 5 also includes cost for fence repair because the excavation may encroach on the existing fence line.

- AOC 6
  - The excavation is assumed to be approximately 2,926 yd^3 of contaminated soil and 433 yd^3 of over excavation. It is assumed that there is no debris present in AOC 6. It is assumed that a portion of the contaminated soil (1,397 yd^3) generated from this area will be disposed as hazardous waste.
  - AOC 6 will be backfilled to original grade to support the site restoration efforts.

- AOC 7
  - The excavation is assumed to be approximately 6,513 yd^3 of contaminated soil, 646 $yd^3$of over excavation, and 1,743 yd^3 of debris. It is assumed that a portion of the contaminated soil (5,377 yd^3) and debris (87 yd^3) generated from this area will be disposed as hazardous waste.

  - AOC 7 will not be backfilled; however, backfill will be brought onsite to support the site restoration efforts, which includes a floodplain depression.
  - Restoration for AOC 7 also includes cost for fence repair because the excavation may encroach on the existing fence line and pavement restoration because the excavation may encroach on the existing road.
- AOC 8
  - The excavation is assumed to be approximately 103 yd^3 of contaminated soil, 81 yd^3 of over excavation, and 37 yd^3 of debris. It is assumed that the contaminated soil and debris generated from this area will be disposed as non-hazardous waste.
  - AOC 8 will be backfilled to original grade to support the site restoration efforts.
- AOC 9 (contained within the Western Drainage Ditch)
  - The excavation is assumed to be approximately 68 yd^3 of contaminated soil, 85 yd^3 of over excavation, and 48 yd^3 of debris. It is assumed that the contaminated soil and debris generated from this area will be disposed as non-hazardous waste.
  - AOC 9 will be backfilled to original grade to support the site restoration efforts.
- AOC 10
  - The excavation is assumed to be approximately 78 yd^3 of contaminated soil, 65 yd^3 of over excavation, and 38 yd^3 of debris. It is assumed that the contaminated soil and debris generated from this area will be disposed as non-hazardous waste.
  - AOC 10 will be backfilled to original grade to support the site restoration efforts.
- AOC 11
  - The excavation is assumed to be approximately 81 yd^3 of contaminated soil, 66 yd^3 of over excavation, and 35 yd^3 of debris. It is assumed that the contaminated soil and debris generated from this area will be disposed as non-hazardous waste.
  - AOC 11 will be backfilled to original grade to support the site restoration efforts.
- Western Drainage Ditch
  - Although the Western Drainage Ditch is not associated with chemically contaminated soil or unacceptable risk (with exception of AOC 9 located within its boundaries), its restoration/regrading will be included as part of this effort. For cost estimating purposes, the excavation is assumed to be approximately 50 yd^3 of non-contaminated soil and 50 yd^3 of debris. It is assumed that the soil and debris generated from this area will be disposed as non-hazardous waste.
  - The Western Drainage Ditch will be backfilled to original grade to support the site restoration efforts.
  - Because the National Pollutant Discharge Elimination System discharge point is at the weir (upstream of the remediation effort), reconfiguration of the Western Drainage Ditch will not require modification to the permit.

For cost-estimating purposes, the construction time for Alternative 2 is 24 weeks. The operation time, for which the LTMgt is being performed, is assumed to be 30 years. The LTMgt needed for the OABG, such as yearly inspections and erosion control repairs, is anticipated to be extensive enough that it will not be accounted for under the current groundwater LTM under OU 3. The LUCs will remain in place indefinitely or until conditions at the OABG achieve UU/UE.

5.2.2.1 Site Restoration

After removal and backfilling efforts are complete, site restoration activities will be conducted across the OABG. Bioengineering approaches using native plantings are proposed for the Western Drainage Ditch channel and riverbank stabilization, which will also act as permanent erosion controls for the site. As part of the restoration effort, the OABG will be graded as necessary to eliminate voids and divots that may present potential negative effects on erosion control, surface water management, and/or present physical hazards. Five treatment types have been defined and their zones delineated to address the anticipated conditions along the riverbank within the OABG (Figures 5-1, 5-2, and 5-3).

- Western Drainage Ditch
- Bank Stabilization with Vegetated Geogrids
- Floodplain Depressions
- Protective Plantings
- Site Restoration Grasses

The actual site restoration plan will be developed during the RD. In addition, requirements set forth by ABL security and the Department of Homeland Security shall be taken into account.

Western Drainage Ditch

The proposed stabilization of the Western Drainage Ditch channel is to construct a step pool series using boulder cross vanes to manage the water volume and flow velocity over the 5.5 percent slope between the existing culvert invert to river's base flow water edge (Figure 5-4). This configuration also adjusts the alignment of the Western Drainage Ditch confluence with the river to reduce the potential for backwater eddy scour during high flow events. The step pool banks would be vegetated with native riparian live stake cuttings and native riparian grasses.

Bank Stabilization with Vegetated Geogrids

Once visible debris and necessary trees have been removed, it is proposed that vegetated geogrids be used to rebuild the riverbank (Figure 5-5). Vegetated geogrids provide a bioengineered bank of approximately 4 feet of clean soil between the river's water edge and debris that may remain in place. The vegetated geogrids would be constructed of high-velocity and shear-stress-tolerant woven coconut fiber (coir) fabric blocks, and are proposed for the lower tiers near the river's base flow water edge, with soil-only wrapped earth lifts as the higher tiers. Stable slopes as steep as 1H: 1V can be constructed from coir fabric-based vegetated geogrids. The treatment zone, approximated as 30 to 40 feet from the river's base flow water edge, would be vegetated with native riparian live stake and live whip cuttings and grasses in the vegetated geogrids, with native riparian trees (2-inch caliper) and shrubs (3-gallon container) along the top of bank area.

Floodplain Depressions

Two locations have been identified as candidates for floodplain depressions—AOC 3 and AOC 7. Including floodplain depressions along the OABG restoration area provides a reduction in backfill material post-removal, improvement of the floodplain function, and increases habitat diversity along the river's riparian corridor. These floodplain depressions may be inundated with water after high-flow and/or rainfall events (Figure 5-6) and native plants will be carefully selected to achieve successful revegetation. Both floodplain depression locations will take advantage of the footprint and planned excavation of contaminated material. Post-removal, the excavation will be partially filled with high organic matter topsoil and replanted with native riparian live stake cuttings and grasses similar to undisturbed locations in close proximity to the site. The control elevations of the floodplain depressions may be earthen and/or natural-looking berms that allow connection to the river at higher than base flow events. The riverbank face of the floodplain depressions may be stabilized and restored using one or more tiers of the vegetated geogrids described above.

Protective Plantings

Based on the extent of debris and contaminated soil identified during the debris characterization and from 95 percent UCL, respectively, most of the riverbank does not require removal and mechanical disturbance is not anticipated. Although the existing vegetation will remain in these areas, protective plantings are recommended along the riverbank to reinforce the natural erosion protection provided by established tree roots and bank coverage by grasses and other herbaceous vegetation (Figure 5-7). This protective planting scheme will help create another barrier against subsurface debris that is left in place from resurfacing. A 10-foot-wide zone from the river bank water edge is proposed to install native riparian shrub live stakes and over-seed with native grasses among the existing vegetation. One tier of vegetated geogrid may be placed at the existing riverbank water edge if additional erosion protection is needed. Planting schemes will be consistent with existing vegetation in undisturbed locations in close proximity to the site.

Site Restoration Grasses

A native grass blend, such as a low-growing wildflower and grass mix, is proposed as the site restoration measure for upslope areas in the OABG not covered in one of the other treatment zones described in this section (Figure 5-8). This treatment zone comprises the 25-foot minimum buffer off the existing chain link fence for the length of the OABG, except at the Western Drainage Ditch. The type of grass blend recommended should only require mowing once annually, which allows for high visibility within the OABG, yet minimizes the potential disturbance to near-surface debris that could be snagged by mowing equipment.

5.2.3 Alternative 3—Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt

Alternative 3 involves the same components as those described in Alternative 2, with the addition listed below:

- *Ex Situ* Treatment
  - *Ex situ* thermal treatment will be implemented to address the hazardous concentrations of TCE (assumed to be 10 mg/kg and greater) before offsite disposal. It is assumed that approximately 9,300 yd^3 of soil will be treated to nonhazardous concentrations and allow for disposal at a RCRA D facility.

    In general, the *ex situ* thermal treatment involves low temperature thermal desorption of VOCs through heating the soil to approximately 400^{o}F. This alternative would also include the treatment of off gas (beyond particulate/dust control) and would likely include a scrubber for the chlorinated compounds. If a direct-fired system is used, the off gas may be treated through thermal oxidation. However, acid generation from the thermal oxidation may also require treatment. The thermal system is delivered on multiple trucks and assembled onsite. Minimal space is required and is typically set up on a concrete slab or flat accessible area.
  - A pre-design study will be conducted in support the RD process to estimate more accurately and precisely the volume of hazardous material and constituents that need to be treated before offsite disposal. If additional analyte groups (for example, metals or explosives) and/or volume requires treatment, the treatment technologies will need to be re-screened and evaluated. This will affect the effectiveness, implementability, and cost of this alternative.

For cost-estimating purposes, the construction time for Alternative 3 is 33 weeks. The operation time, for which the LTMgt is being performed, is assumed to be 30 years. LTMgt needed for the OABG, such as yearly inspections and erosion control repairs, are anticipated to be extensive enough that they will not be accounted for under the current groundwater LTM under OU 3. The LUCs will remain in place indefinitely or until conditions at the OABG support UU/UE.

5.3 Evaluation Criteria

The detailed alternative analysis is the means for assembling and evaluating technical and policy considerations to develop the rationale for selecting a remedy. Each alternative was developed to address potential threats to human health and the environment posed by contaminated soil. The NCP requires remedial alternatives to be evaluated against the nine evaluation criteria listed below.

Threshold Criteria

- Protection of human health and the environment
- Compliance with ARARs

Balancing Criteria

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Criteria

- State acceptance
- Community acceptance

The first two criteria are requirements that must be met unless specific ARARs are waived. The first seven criteria are addressed in the FS. The last two criteria will be addressed in the Proposed Plan and ROD. Figure 5-9 shows in further detail the subcriteria being evaluated under each of the NCP criteria.

The cost estimates presented in this report provide an accuracy of +50 percent to -30 percent. The estimates are in 2013 dollars and are based on conceptual design information available at the time of this study. The actual cost of the project would depend on the final scope and design of the selected remedial action, the schedule of implementation, competitive market conditions, and other variables. Most of these factors are not anticipated to affect the relative cost differences between alternatives. The cost estimates were prepared in general conformance with *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA, 2000).

Expenditures that occur over different time periods are returned to present worth, which discounts future costs to a common base year. Present-worth analysis allows the cost of the remedial alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover costs associated with the life of the remedial project. Assumptions associated with the present-worth calculations include discount rates of 1.1 percent for a 5-year and 3.0 percent for a 30-year or longer timeframe[2] (Office of Management and Budget, 2012), cost estimates in the planning years in constant dollars, and a period of performance that would vary depending on the activity, but would not exceed 30 years.

The FS quantitatively evaluated sustainability metrics based on the *Sustainable Environmental Remediation Fact Sheet* (Navy, 2009) and in consideration of *Principles for Greener Cleanups* (EPA, 2009) and *Greener Cleanup and Sustainable Reuse Policy* (EPA, 2010). A sustainability analysis was performed using SiteWise, a tool developed jointly by Battelle, the Navy, and U.S. Army Corps of Engineers. ABG Alternative 2 and OABG Alternatives 2 and 3 were analyzed in order to focus on the remedies that meet ARARs and achieve the RAOs. The detailed sustainability analysis is presented in Appendix D.

The sustainability analysis evaluated the environmental footprint of each remedial alternative considered in terms of metrics, including:

- Energy consumption
- Greenhouse gas (GHG) emissions, focusing on embodied carbon, which includes carbon dioxide, methane, and nitrous oxide
- Criteria air pollutant emissions, focusing on sulfur oxides, nitrogen oxides, and particulate matter
- Water consumption
- Resource consumption (for example, landfill space)
- Worker safety

[2] Nominal discount rate on Treasury notes and bonds from http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c

Table 5-1 summarizes how each of the sustainability metrics is addressed under the existing NCP criteria. The metrics are most effectively addressed in the two NCP criteria of (1) long-term effectiveness and permanence and (2) short-term effectiveness. GHG emissions are considered a component of long-term effectiveness because of their persistence in the atmosphere. The other metrics are considered components of short-term effectiveness.

The SiteWise assessment is broken down into modules that mirror the phases of remedial action work, specifically: RI, remedial action construction, remedial action operation, and LTM. SiteWise compares the different alternatives in terms of five metrics: (1) GHG emissions; (2) energy use; (3) air emissions of criteria pollutants, specifically oxides of nitrogen, sulfur oxides, and particulate matter; (4) water consumption; and (5) worker safety. SiteWise drills down further to the type of activity associated with each metric evaluated. The activities are grouped into the following categories:

- Residual handling (includes the transportation of waste)
- Equipment use and misc. (includes emissions related to heavy equipment use and *ex situ* treatment operations)
- Transportation – equipment and material such as soil for backfill
- Transportation – personnel
- Consumables (includes materials that are completely consumed and cannot be reused during the application of the alternative, including soil for backfill)

A lower environmental footprint indicates less-harmful impacts to environmental and social metrics, which collectively make up the SiteWise sustainability metrics. Conversely, a higher environmental footprint indicates higher harmful impacts associated with the SiteWise metrics.

5.4 Detailed Evaluation of Remedial Alternatives

This section discusses evaluation of the remedial alternatives listed previously against the seven criteria. Table 5-2 and Table 5-3 compare each alternative with respect to the FS evaluation criteria for the ABG and OABG, respectively. Table 5-4 and Table 5-5 summarize the projected remediation costs for the ABG and OABG, respectively.

5.4.1 Active Burning Ground

This section describes the detailed evaluation of the ABG remedial alternatives against the seven NCP criteria.

5.4.1.1 Alternative 1—No Action

The no-action alternative is required by the NCP and serves as the baseline alternative. All other remedial alternatives are judged against the no-action alternative. Under this alternative, no controls or remedial technologies would be implemented.

Overall Protection of Human Health and the Environment

This alternative does not prevent direct contact with the COCs in soil. This alternative does not contain measures to prevent migration of COCs into the surface water or groundwater via overland flow and leaching to groundwater, respectively. The human health and ecological risks posed by contaminated soil would not be decreased because the risk of potential future exposures would continue. The no-action alternative is not protective of human health and the environment.

Compliance with ARARs

This alternative does not meet the applicable chemical- and location-specific ARARs. There are no applicable action-specific ARARs because no remedial actions would be undertaken with this remedial alternative.

Long-term Effectiveness and Permanence

Alternative 1 offers no ability to monitor its long-term effectiveness and does not provide permanence. There would be no prevention of direct contact with the soil COCs, no reduction in contaminant migration, and no reduction in risk to human receptors, ecological receptors, or soil-to-groundwater leaching under this alternative.

Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 1 does not include treatment.

Short-term Effectiveness

Alternative 1 offers no ability to monitor its effectiveness. There is no construction associated with Alternative 1; therefore, there are no short-term impacts on workers, the community, or the environment. However, the RAOs and therefore the SRGs cannot be achieved.

Implementability

Implementability evaluation for this alternative primarily includes technical and administrative feasibility:

- ***Technical Feasibility –*** Alternative 1 does not have a monitoring or construction component; therefore, there are no issues concerning its technical feasibility.
- ***Administrative Feasibility –*** The administrative implementability of this alternative is low in terms of its ability to obtain approvals from regulatory agencies.

Cost

Taking no action would require no expenditure.

5.4.1.2 Alternative 2—Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt

The components of Alternative 2 are described in Section 5.1.2.

Overall Protection of Human Health and the Environment

Alternative 2 is protective of human health and the environment. Because the soil will be excavated and removed from the site, Alternative 2 prevents direct contact with the soil COCs, minimizes the human health and ecological risk posed by contaminated soil, and contains measures to prevent migration of COCs into the surface water or groundwater via overland flow and leaching to groundwater, respectively. The RAOs and therefore the SRGs would be achieved immediately after construction completion. Alternative 2 mitigates the potential human health risk under the industrial scenario; however, any continued human health risk will be mitigated by LUCs. Alternative 2 mitigates the potential ecological and soil-to-groundwater leaching risk and achieves an unrestricted land use for these receptors.

Compliance with ARARs

This alternative would comply with the action-, location-, and chemical-specific ARARs identified in Appendix B. For example, the chemical-specific ARARs would be met by eliminating soil-to-groundwater leaching of COCs, and the action-specific disposal controls would be met through soil characterization and appropriate disposal. The location-specific ARARs with regard to the floodplain would be met through erosion controls and appropriate grading.

Long-term Effectiveness and Permanence

Because the source of soil contamination would be permanently removed from the site, Alternative 2 would reduce the residual risks associated with the COCs to acceptable levels at the site and would satisfy the long-term effectiveness and permanence criteria.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 2 does not include treatment. However, this alternative would ultimately reduce the toxicity, mobility, and volume of contaminants through removal of the contaminated soil and disposal to an appropriately permitted facility.

Short-term Effectiveness

Under Alternative 2, RAOs would be met within approximately 5 weeks (soil will be removed and disposed of offsite within approximately 5 weeks). This duration may be longer to facilitate the periodic burning activities that occur at the ABG which prohibits personnel from being onsite. During this period, the ABG daily operations may be affected because of the excavation activities and transportation of the excavated material offsite. Short-term impacts to the remediation workers resulting from the implementation of this alternative would be minimized through the use of appropriate health and safety practices and properly trained personnel. Also, erosion control measures would be installed to minimize discharge of waste from the ABG during excavation. In addition, transportation of the excavated material to the offsite landfills and transportation of clean fill from an offsite source may create temporary traffic disturbances that may decrease the productivity of the facility and would increase the risk of traffic accidents and emissions in the local community.

Alternative 2 was estimated to emit approximately 130 metric tons of carbon dioxide equivalents. The environmental footprint of Alternative 2 is primarily driven by impacts associated with borrow pit operations for backfill and transportation of fill and waste to and from the site. Onsite labor hours during construction activities accounted for most of the accident risk injury footprint with contributions from transportation, of both personnel and equipment and materials, including waste. Transportation and onsite labor hours each contributed evenly to the accident risk fatality footprint.

Implementability

Implementability evaluation for this alternative primarily includes technical and administrative feasibility:

- ***Technical Feasibility –*** Alternative 2 includes excavation and offsite disposal, both of which are technically feasible because the technologies use standard practices. There are no issues concerning the technical feasibility of implementing LUCs and LTMgt (being addressed under the current groundwater LTM under OU-3).
- ***Administrative Feasibility –*** Alternative 2 includes excavation and offsite disposal, both of which are administratively feasible. However, it should be noted that implementation of any remedy within the ABG must comply with scheduling requirements set forth by ATK and ensure the mission-critical activities in this area are met. There are no issues concerning the administrative feasibility of implementing LUCs and LTMgt (being addressed under the current groundwater LTM under OU-3). The administrative implementability of this alternative is high in terms of its ability to obtain approvals from regulatory agencies.

Cost

Alternative 2 has an estimated capital cost of $718,695. This cost is associated primarily with the excavation, transportation, and offsite disposal of the contaminated soil. O&M activities include yearly inspections to ensure the remedy continues to achieve the RAOs. The cost estimate details are provided in Appendix C.

5.4.2 Outside Active Burning Ground

5.4.2.1 Alternative 1—No Action

The no-action alternative is required by the NCP and serves as the baseline alternative. All other remedial alternatives are judged against the no-action alternative. Under this alternative, no controls or remedial technologies would be implemented.

Overall Protection of Human Health and the Environment

This alternative does not prevent direct contact with the COCs in soil. This alternative does not contain measures to prevent migration of COCs into the surface water or groundwater via overland flow and leaching to groundwater, respectively. The human health and ecological risks posed by contaminated soil would not be decreased because the risk of potential future exposures would continue. The no-action alternative is not protective of human health and the environment.

Compliance with ARARs

This alternative does not meet the applicable chemical- and location-specific ARARs. There are no applicable action-specific ARARs because no remedial actions would be undertaken with this remedial alternative.

Long-term Effectiveness and Permanence

Alternative 1 offers no ability to monitor its long-term effectiveness and does not provide permanence. There would be no prevention of direct contact with the soil COCs, no reduction in contaminant migration, and no reduction in risk to human receptors, ecological receptors, or soil-to-groundwater leaching under this alternative.

Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 1 does not include treatment.

Short-term Effectiveness

Alternative 1 offers no ability to monitor its effectiveness. There is no construction associated with Alternative 1; therefore, there are no short-term impacts on workers, the community, or the environment. However, the RAOs and therefore the SRGs cannot be achieved.

Implementability

Implementability evaluation for this alternative primarily includes technical and administrative feasibility:

- ***Technical Feasibility –*** Alternative 1 does not have a monitoring or construction component; therefore, there are no issues concerning its technical feasibility.
- ***Administrative Feasibility –*** The administrative implementability of this alternative is low in terms of its ability to obtain approvals from regulatory agencies.

Cost

Taking no action would require no expenditure.

5.4.2.2 Alternative 2—Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt

The components of Alternative 2 are presented in Section 5.2.2.

Overall Protection of Human Health and the Environment

Alternative 2 is protective of human health and the environment. Because the soil and debris will be excavated and removed from the site, Alternative 2 prevents direct contact with the soil COCs, minimizes the human health and ecological risk posed by contaminated soil, and contains measures to prevent migration of COCs into the surface water or groundwater via overland flow and leaching to groundwater, respectively. The RAOs and therefore the SRGs would be achieved immediately after construction completion. Alternative 2 mitigates the potential human health risk under the industrial scenario; however, continued human health risk will be mitigated by LUCs. Alternative 2 mitigates the potential ecological and soil-to-groundwater leaching risk and achieves an unrestricted land use for these receptors.

Compliance with ARARs

This alternative would comply with the action-, location-, and chemical-specific ARARs identified in Appendix B. For example, the chemical-specific ARARs would be met by eliminating soil-to-groundwater leaching of COCs, and the action-specific disposal controls would be met through soil characterization and appropriate disposal. The location-specific ARARs with regard to the floodplain would be met through erosion controls and appropriate grading.

Long-term Effectiveness and Permanence

Because sources of soil contamination would be permanently removed from the site, Alternative 2 would reduce the residual risks associated with the COCs to acceptable levels at the site and would satisfy the long-term effectiveness and permanence criteria. The sustainable restoration approach along the riverbank within the OABG is focused on using native plants and grasses for enduring, regenerative stabilization of the bank that will provide long-term erosion protection. The bank restoration approach's success, however, is tied to allowing the vegetation to thrive. Improper management of the vegetation or substantial changes to the river's watershed will lessen the strength of the bank restoration approach.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 2 does not include treatment. However, this alternative would ultimately reduce the toxicity, mobility, and volume of contaminants through removal of the contaminated soil and debris and disposal to appropriately permitted facilities.

Short-term Effectiveness

Under Alternative 2, RAOs would be met within approximately 24 weeks (soil and debris will be removed and disposed of offsite within approximately 24 weeks). This duration may be longer to facilitate the periodic burning activities that occur at the ABG, which prohibits personnel from being onsite. No periodic operations at the OABG would be affected because of the excavation activities; however overall ABL activities may be periodically disrupted through transportation of the excavated material through the facility and offsite. Short-term impacts to the remediation workers resulting from the implementation of this alternative would be minimized through the use of appropriate health and safety practices and properly trained personnel. This includes UXO technicians and asbestos abatement personnel. Also, erosion control measures would be installed to minimize discharge of waste from the OABG during excavation. In addition, transportation of the excavated material to the offsite landfills and transportation of clean fill from an offsite source may create temporary traffic disturbances that may decrease the productivity of the facility and would increase the risk of traffic accidents and emissions in the local community.

Alternative 2 was estimated to emit approximately 2,150 metric tons of carbon dioxide emissions. The environmental footprint of Alternative 2 is primarily driven by the offsite disposal of the excavated material, including transportation of waste to hazardous and non-hazardous landfills. The potential accident risk, both fatality and injury footprints, for Alternative 2 was primarily driven by waste transportation, with lesser contributions from personnel and fill transportation and onsite labor hours.

Implementability

Implementability evaluation for this alternative primarily includes technical and administrative feasibility:

- ***Technical Feasibility –*** Alternative 2 includes removal of surface debris, excavation, and offsite disposal, all of which are technically feasible because the technologies use standard practices. There are no issues concerning the technical feasibility of implementing LUCs and LTMgt.
- ***Administrative Feasibility –*** Alternative 2 includes removal of surface debris, excavation, and offsite disposal, all of which are administratively feasible. The established protocols set forth by NOSSA, and as documented in the ESS, may have substantial short-term impacts to the facility operations, and to production, implementation, and cost of Alternative 2. Implementation of any remedy within the OABG must comply with scheduling requirements set forth by ATK and ensure the mission-critical activities within the ABG area are met. There are no issues concerning the administrative feasibility of implementing LUCs and LTMgt (being addressed under the current groundwater LTM under OU-3). The administrative implementability of this alternative is high in terms of its ability to obtain approvals from regulatory agencies.

Cost

Alternative 2 has an estimated capital cost of $10,194,241. This cost is associated primarily with the excavation, transportation, and offsite disposal of the contaminated soil and debris. O&M activities include yearly inspections to ensure the remedy continues to achieve the RAOs. The cost estimate details are provided in Appendix C.

5.4.2.3 Alternative 3—Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs, and LTMgt

The components of Alternative 3 are presented in Section 5.2.3.

Overall Protection of Human Health and Environment

Alternative 3 is protective of human health and the environment. Because the soil and debris will be excavated, treated, and removed from the site, Alternative 3 prevents direct contact with the soil COCs, minimizes the human health and ecological risk posed by contaminated soil, and contains measures to prevent migration of COCs into the surface water or groundwater via overland flow and leaching to groundwater, respectively. The RAOs and therefore the SRGs would be achieved immediately after construction completion. Alternative 3 mitigates the potential human health risk under the industrial scenario; however, any continued human health risk will be mitigated by LUCs. Alternative 3 mitigates the potential ecological and soil-to-groundwater leaching risk and achieves an unrestricted land use for these receptors.

Compliance with ARARs

This alternative would comply with the action-, location-, and chemical-specific ARARs identified in Appendix B. For example, the chemical-specific ARARs would be met by eliminating soil-to-groundwater leaching of COCs, and the action-specific disposal controls would be met through soil characterization, *ex situ* treatment, and appropriate disposal. The location-specific ARARs with regard to the floodplain would be met through erosion controls and appropriate grading.

Long-term Effectiveness and Permanence

Because sources of soil contamination would be permanently removed from the site, Alternative 3 would reduce the residual risks associated with the COCs to acceptable levels at the site and would satisfy the long-term effectiveness and permanence criteria. The sustainable restoration approach along the riverbank within the OABG is focused on using native plants and grasses for enduring, regenerative stabilization of the bank that will provide long-term erosion protection. The bank restoration approach's success, however, is tied to allowing the vegetation to thrive. Improper management of the vegetation or substantial changes to the river's watershed will lessen the strength of the bank restoration approach.

Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative includes *ex situ* treatment of contaminated soil to meet non-hazardous disposal requirements. This alternative would ultimately address toxicity, mobility, and volume of contaminants at the site through removal of the contaminated soil and debris to an appropriately permitted facility.

Short-term Effectiveness

Under Alternative 3, RAOs would be met within approximately 33 weeks (soil and debris will be removed, treated, and disposed of offsite within approximately 33 weeks). This duration may be longer to facilitate the periodic burning activities that occur at the ABG, which prohibits personnel from being onsite. No periodic operations at the OABG would be affected because of the excavation and treatment activities; however overall ABL activities may be periodically disrupted through transportation of the excavated/treated material through the facility and offsite. Short-term impacts to the remediation workers resulting from the implementation of this alternative would be minimized through the use of appropriate health and safety practices and properly trained personnel. This includes UXO technicians and asbestos abatement personnel. Also, erosion control measures would be installed to minimize discharge of waste from the OABG during excavation. In addition, transportation of the excavated material to the offsite landfills and transportation of clean fill from an offsite source may create temporary traffic disturbances that may decrease the productivity of the facility and would increase the risk of traffic accidents and emissions in the local community.

Alternative 3 was estimated to emit approximately 3,700 metric tons of GHG emissions. The environmental footprint of Alternative 3 is primarily driven by fuel use for the *ex situ* thermal treatment and handling of the excavated material. The potential accident risk for Alternative 3 is primarily driven by onsite labor hours and fill and waste transportation.

Implementability

Implementability evaluation for this alternative primarily includes technical and administrative feasibility:

- ***Technical Feasibility –*** Alternative 3 includes removal of surface debris, excavation, ex situ thermal treatment of TCE, and offsite disposal, all of which are technically feasible because the technologies use standard practices. There are no issues concerning the technical feasibility of implementing LUCs and LTMgt.
- ***Administrative Feasibility –*** Alternative 3 includes removal of surface debris, excavation, ex situ thermal treatment of TCE, and offsite disposal, all of which are administratively feasible. The established protocols set forth by NOSSA, and as documented in the ESS, may have substantial short-term impacts to the facility operations and to production, implementation, and cost of Alternative 3. Implementation of any remedy within the OABG must comply with scheduling requirements set forth by ATK and ensure the mission-critical activities within the ABG area are met. There are no issues concerning the administrative feasibility of implementing LUCs and LTMgt. The administrative implementability of this alternative is high in terms of its ability to obtain approvals from regulatory agencies.

Cost

Alternative 3 has an estimated capital cost of $8,334,872. This cost is associated primarily with the excavation, *ex situ* treatment, transportation, and offsite disposal of the contaminated soil and debris. O&M activities include yearly inspections to ensure the remedy continues to achieve the RAOs. The cost estimate details are provided in Appendix C.

5.5 Comparative Analysis of Remedial Alternatives

In this section, the remedial alternatives are discussed in relation to one another for each of the seven NCP criteria. The purpose of this discussion is to identify the relative advantages and disadvantages of each alternative.

5.5.1 Active Burning Ground

5.5.1.1 Protection of Human Health and the Environment

Alternative 1 is not protective of human health and the environment because no action would be taken to mitigate unacceptable risks. This alternative does not contain measures to prevent direct contact with the soil COCs or prevent migration of COCs into the surface water or groundwater via overland flow and leaching to groundwater, respectively. The human health and ecological risks posed by contaminated soil would not be decreased because the risk of potential future exposures would continue.

Alternative 2 is protective of human health and the environment because the contaminated soil would be excavated and removed from the site, which would mitigate unacceptable risks for current and reasonably anticipated future land use. This alternative contains measures to prevent direct contact with the soil COCs and to prevent migration of COCs into the surface water or groundwater via overland flow and leaching to groundwater, respectively. The human health and ecological risks posed by contaminated soil would also be decreased because the risk of potential future exposures would be removed.

5.5.1.2 Compliance with ARARs

Alternative 1 does not meet the applicable chemical- and location-specific ARARs. There are no applicable action-specific ARARs because no remedial actions would be undertaken with this remedial alternative. Alternative 2 would comply with the action-, location-, and chemical-specific ARARs. Alternative 2 requires that LUCs are implemented to limit the site to industrial use and ensuring appropriate industrial land use is maintained to minimize the potential for human exposure to contamination. In addition, Alternative 2 requires the implementation a groundwater LTMgt plan (under OU-3) to ensure the remedy components are maintained and continue to meet the RAOs.

5.5.1.3 Long-term Effectiveness and Permanence

Alternative 1 does not provide long-term effectiveness and permanence. In addition, Alternative 1 offers no ability to monitor its long-term effectiveness. There would be no prevention of direct contact with the soil COCs, no reduction in contaminant migration, and no reduction in risk to human receptors, ecological receptors, or soil-to-groundwater leaching under this alternative.

Because the soil contamination would be permanently removed from the site, Alternative 2 would reduce the residual risks associated with the COCs to acceptable levels at the site and would satisfy the long-term effectiveness and permanence criteria. Alternative 2 would continue to be effective as long as the remedy is maintained over time and LUCs are in place.

5.5.1.4 Reduction in Toxicity, Mobility, and Volume through Treatment

Although neither Alternative 1 nor 2 involve treatment, Alternative 2 would ultimately reduce the toxicity, mobility, and volume of contaminants through removal of the contaminated soil and disposal to an appropriately permitted facility.

5.5.1.5 Short-term Effectiveness

Alternative 1 offers no ability to monitor its short-term effectiveness and ability to achieve the RAOs. Alternative 1 imparts no short-term risks associated with the remedy implementation and no short-term impacts on ABL operations because no active components would be planned under this alternative.

Alternative 2 would achieve the RAOs in approximately 5 weeks once construction completion is achieved. The short-term risks associated with the construction activities under Alternative 2 would be minimized through the implementation of the appropriate health and safety procedures. Short-term disruptions to daily ABL operations and the local community may be experienced from heavy equipment operation, such as increased traffic of construction trucks in and out of the site; dust generation from heavy equipment during re-grading, excavation, or backfill operations; and transportation of clean fill from an offsite source. These disruptions would be minimized, to the extent practical, through proper planning for traffic diversion and periodic dust suppression.

Because no action occurs for Alternative 1, it does not have sustainability impacts. However, a sustainability analysis was completed for Alternative 2 to evaluate the overall sustainability footprint and identify activities that have the highest potential impacts which can be optimized during the design phase. The activity that contributed the most to the GHG footprint was fill production and transportation; if possible, minimizing the amount of offsite fill would help reduce the overall GHG footprint. During the RD, alternate materials and best management practices can be investigated and implemented to reduce the environmental footprint of the selected alternative. The detailed sustainability analysis for Alternative 2 is presented in Appendix D.

5.5.1.6 Implementability

Both Alternative 1 and Alternative 2 are technically feasible. Alternative 1 does not have a monitoring or construction component; therefore, there are no issues concerning its technical feasibility. Alternative 2, which includes excavation and offsite disposal, would be readily implementable because the technology is well-accepted, conventional, and has been used successfully at many other sites.

Alternative 1 is not likely to be administratively implementable given the unlikelihood of obtaining approval from the regulatory agencies. Alternative 2 is administratively implementable.

5.5.1.7 Cost

As shown in Table 5-4, the capital costs of Alternative 1 and Alternative 2 are $0 and $718,695, respectively. The total present-worth costs for Alternative 1 and Alternative 2 are $0 and $718,695, respectively. The primary costs for Alternative 2 are associated with the excavation and offsite disposal of the contaminated soil to a non-hazardous landfill. Costs are within the -30 percent to +50 percent degree of accuracy associated with conceptual-level cost estimates for the FS outlined by the EPA guidance (EPA, 2000).

5.5.2 Outside Active Burning Ground

In this section, the remedial alternatives for the OABG are discussed in relation to one another for each of the seven NCP criteria. The purpose of this analysis is to identify the relative advantages and disadvantages of each alternative.

5.5.2.1 Protection of Human Health and the Environment

Alternative 1 is not protective of human health and the environment because no action would be taken to mitigate unacceptable risks. This alternative does not contain measures to prevent direct contact with the soil COCs or prevent migration of COCs into the surface water or groundwater via overland flow and leaching to groundwater, respectively. The safety risks (bodily injury, lacerations, etc.) posed by the surface debris would remain. The human health and ecological risks posed by contaminated soil would not be decreased because the risk of potential future exposures would continue.

Alternative 2 and Alternative 3 are protective of human health and the environment and are comparable under this criterion. The contaminated soil would be excavated and removed from the site under both alternatives, which would mitigate unacceptable risks. These alternatives contain measures to prevent direct contact with the soil COCs and to prevent migration of COCs into the surface water or groundwater via overland flow and leaching to groundwater, respectively. The safety risks posed by the surface debris would also be eliminated. The human health and ecological risks posed by contaminated soil would also be decreased because the risk of potential future exposures would be removed. In addition, Alternative 2 and Alternative 3 offer a secondary benefit to the environment through the restoration of the river bank using sustainable methods and re-establishment of floodplain.

5.5.2.2 Compliance with ARARs

Alternative 1 does not meet the applicable chemical- and location-specific ARARs. There are no applicable action-specific ARARs because no remedial actions would be undertaken with this remedial alternative. Alternative 2 and Alternative 3 would comply with the action-, location-, and chemical-specific ARARs and are comparable under this criterion.

5.5.2.3 Long-Term Effectiveness and Permanence

Alternative 1 does not provide long-term effectiveness and permanence, nor does it offer the ability to monitor its long-term effectiveness. There would be no prevention of direct contact with the soil COCs, no reduction in contaminant migration, and no reduction in risk to human receptors, ecological receptors, or soil-to-groundwater leaching under this alternative.

Because much of the soil contamination would be permanently removed from the site, both Alternative 2 and Alternative 3 would reduce the residual risks associated with the COCs to acceptable levels at the site and would satisfy the long-term effectiveness and permanence criteria. Both alternatives would continue to be effective as long as the remedy is maintained over time and LUCs are in place.

5.5.2.4 Reduction in Toxicity, Mobility, and Volume through Treatment

Neither Alternatives 1 nor 2 involve treatment. Alternative 3 includes *ex situ* thermal treatment of contaminated soil containing concentrations of TCE greater than 10 mg/kg to meet non-hazardous disposal requirements. Both Alternative 2 and Alternative 3 would ultimately address toxicity, mobility, and volume of contaminants at the site through removal of the contaminated soil and debris to an appropriately permitted facility.

5.5.2.5 Short-term Effectiveness

Alternative 1 offers no ability to monitor its short-term effectiveness and ability to achieve the RAOs. Alternative 1 imparts no short-term risks associated with the remedy implementation and no short-term impacts on ABL operations because no active components would be planned under this alternative.

Alternative 2 would achieve the RAOs in approximately 24 weeks once construction completion is achieved. Alternative 3 would achieve RAOs in approximately 33 weeks once construction completion and thermal treatment is achieved. The short-term risks associated with the construction activities under Alternatives 2 and 3 would be minimized by implementing the appropriate health and safety procedures. For the OABG, this includes UXO technicians and asbestos abatement personnel providing oversight. Short-term disruptions to daily ABL operations and the local community may be experienced from heavy equipment operation, such as increased traffic of construction trucks in and out of the site; dust generation from heavy equipment during re-grading, excavation, or backfill operations; and transportation of clean fill from an offsite source. These disruptions would be minimized, to the extent practical, through proper planning for traffic diversion and periodic dust suppression.

Of the two alternatives subject to the sustainability analysis, Alternative 2 had the lowest estimated GHG emissions, followed by Alternative 3, which was estimated to have almost twice as much as Alternative 2. Alternative 2 also had the smallest total energy, water use, and nitrogen oxide footprints. Alternative 3 had the smallest accident risk of fatality footprint. Although quantitatively the remaining criteria air pollutant footprints (sulfur oxide and PM10) and accident risk injury footprints were different for both alternatives, they were within 30 percent of each other and considered similar based on inherent uncertainty in the SiteWise model. During the RD, alternative materials and best management practices can be investigated and implemented in order to reduce the environmental footprint of the selected alternative. The detailed sustainability analysis for Alternatives 2 and 3 is presented in Appendix D.

5.5.2.6 Implementability

All alternatives are technically feasible. Alternative 1 does not have a monitoring or construction component; therefore, there are no issues concerning its technical feasibility. Alternative 2, which includes surface debris removal, excavation and offsite disposal, would be readily implementable because the technology is well-accepted, conventional, and have been used successfully at many other sites. Alternative 3, which includes surface debris removal, excavation, *ex situ* thermal treatment, and offsite disposal, would be readily implementable because the technology is well-accepted, conventional, and have been used successfully at many other sites.

Alternative 1 is not likely to be administratively implementable given the unlikelihood of obtaining approval from the regulatory agencies. Alternative 2 and Alternative 3 are administratively implementable.

5.5.2.7 Cost

As shown in Table 5-5, the capital costs of Alternative 1, Alternative 2, and Alternative 3 are $0, $10,194,241, and $8,334,872, respectively. The total present-worth costs for Alternative 1, Alternative 2, and Alternative 3 are $0, $10,335,491, and $8,476,121, respectively. The primary costs for Alternative 2 are associated with the excavation and offsite disposal of the contaminated soil and debris to certified RCRA D and RCRA C landfills. The primary costs for Alternative 3 are associated with the excavation, *ex situ* thermal treatment of TCE, and offsite disposal of the contaminated soil and debris to a certified RCRA D landfill. Costs are within the -30 percent to +50 percent degree of accuracy associated with conceptual-level cost estimates for the FS outlined by the EPA guidance (EPA, 2000).

5.6 Uncertainties

Development and evaluation of the remedial alternatives for Site 1 soil is based, largely in part, on three significant assumptions:

1. The lateral and vertical extent of chemically contaminated soil (AOCs) to be remediated as defined by the 95 percent UCL of sitewide concentrations of COCs, is assumed. This assumption includes the spatial location, depths, volumes, chemical constituents, and concentrations within each AOC based on existing site data. This assumption is reflected in the feasibility, effectiveness, implementability, and cost for each alternative. The alternatives that would most be affected by the uncertainties in this assumption are those that include excavation and offsite disposal (ABG Alternative 2, OABG Alternative 2, and OABG Alternative 3). A pre-design study will be conducted to delineate more precisely the lateral and vertical extent of contamination in support the remedial design process.

2. It is assumed that contaminated soil deemed to be hazardous will be driven by the presence of TCE at concentrations of more than 10 mg/kg. Based on the current soil data, this assumption is an effective breakpoint to evaluate the viable treatment technologies and transportation and disposal costs for each alternative. This assumption is reflected in the feasibility, effectiveness, implementability, and cost for each alternative. The alternatives that would most be affected by the uncertainties in this assumption are those that include offsite disposal and/or *ex situ* treatment of hazardous waste (OABG Alternative 2 and OABG Alternative 3). A pre-design study will be conducted to assess more accurately and precisely the characteristic nature and volume of the contaminated soil in support the remedial design process.

3. It is assumed that *ex situ* thermal treatment can achieve non-hazardous disposal requirements. Related to assumption 2, it is assumed that TCE is the only COC that needs to be treated to achieve non-hazardous disposal requirements. Based on the technology screening, thermal treatment was the least time- consuming and most cost-effective technology to treat TCE to non-hazardous levels. However, if the results of the pre-design study indicate that additional analyte groups require treatment, thermal treatment alone may not be effective. In addition, changes to the treatment volume and/or contaminant concentrations may increase or decrease the cost of the *ex situ* treatment component. The alternative that would most be affected by the uncertainties in this assumption is the one that includes *ex situ* treatment of hazardous waste (OABG Alternative 3).

Because the extent of residual contamination at FDP 1 and FDP 3 within the ABG is unknown at this time, volume and associated costs have not been generated as part of this FS report. In addition, because the extent of surface debris within the OABG is unknown at this time, the estimated volume of surface debris has been estimated as 5 times the volume removed during the 2008 OABG limited surface debris removal. Costs associated with these items are not anticipated to alter the estimate to such an extent that would affect the +50 percent/-30 percent accuracy.

Table 5-1
NCP Criteria and Sustainability Metrics
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

NCP Criteria	Subcriteria	Sustainability Metrics					
		Energy Consumption	GHG Emissions	Criteria Pollutants Emission	Resource Consumption	Worker Impact	Community Impacts
Protection of Human Health and the Environment	Protection of Human Health and Environment						
Compliance with ARARs	Compliance with Chemical-Specific ARARs						
	Compliance with Action-Specific ARARs						
	Compliance with Location-Specific ARARs						
	Compliance with other criteria, advisories, and guidance						
Long-Term Effectiveness and Permanence	Magnitude of Residual Risk		E	E			
	Adequacy and reliability of controls						
Reduction in Toxicity, Mobility, and Volume	Treatment Process used and materials treated						
	Amount of Hazardous materials destroyed or treated						
	Degree of Expected Reductions in Toxicity, Mobility, and Volume						
	Degree of which treatment is irreversible						
	Type and Quantity of Residual Remaining After Remedial Action						
Short-Term Effectiveness	Protection of Community During Remedial Action						A
	Protection of Workers During Remedial Action					B	
	Environmental Impacts	F	E	D	C		
	Time until RAOs are achieved						
Implementability	Ability to construct and operate the Technology						
	Reliability of the Technology						
	Ease of undertaking additional remedial actions, if necessary						
	Ability to Monitor Effectiveness of Remedy						
	Ability to obtain approvals from other agencies						
	Coordination with other agencies						
	Availability of offsite treatment, storage, and disposal services and capacity						
	Availability of necessary equipment and specialists						
	Availability of Prospective Technologies						
Cost	Capital Costs						
	Operating and Maintenance Costs						
	Present Worth Costs						

Legend:
A - Compliments NCP criteria but also addresses risks to community in terms of potential for injury or fatality associated with traffic
B - Compliments NCP criteria but also addresses potential for injury or fatality associated with total hours worked
C - Use of non-renewable energy (coal for power requirements [fuel])
D - Impacts associated with release of VOCs to the atmosphere
E - Some emissions persist only in the short term; others last for decades and may persist after RAOs have been achieved
F - Environmental impacts associated with energy extraction from earth resources

Table 5-2
Comparative Analysis of Remedial Alternatives for the ABG
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
Overall Protection of Human Health and the Environment	Not protective of human health and the environment.	This alternative satisfies the protection of human health and environment criterion because soil that may represent a potential source of contamination will be excavated and removed from the site. The RAOs, and therefore the SRGs, would be achieved immediately after construction completion.
Compliance with ARARs	This alternative does not meet the applicable chemical- and location-specific ARARs. There are no applicable action-specific ARARs because no remedial actions would be undertaken with this remedial alternative.	This alternative would comply with the action-, location-, and chemical-specific ARARs identified in Appendix C. For example, the chemical-specific ARARs would be met by eliminating soil-to-groundwater leaching of COCs, and the action-specific disposal controls would be met through soil characterization and appropriate disposal. The location-specific ARARs with regard to the floodplain would be met through erosion controls and appropriate grading.
Long-Term Effectiveness and Permanence	Alternative 1 does not provide long-term effectiveness and permanence. There would be no prevention of direct contact with the soil COCs, and no reduction in risk to human receptors, ecological receptors, or soil-to-groundwater leaching under this alternative.	Because the source of soil contamination would be permanently removed from the site, Alternative 2 would reduce the residual risks associated with the COCs to acceptable levels at the site and would satisfy the long-term effectiveness and permanence criteria. Emissions (NOx, PM10, and carbon dioxide associated with GHG and criteria pollutants) from transportation and heavy machinery use persist for an extended period after RAOs are achieved. Quantity of emissions is relatively higher than in Alternative 1.
Reduction of Toxicity, Mobility, or Volume Through Treatment	Alternative 1 does not include treatment.	Alternative 2 does not include treatment. However, this alternative would ultimately reduce the toxicity, mobility, and volume of contaminants through removal of the contaminated soil and disposal to an appropriately permitted facility.
Short-Term Effectiveness	There is no construction associated with Alternative 1; therefore, there are no short-term impacts on workers, the community, or the environment. However, the RAOs and, therefore, the SRGs cannot be achieved.	Under Alternative 2, RAOs would be met within approximately 5 weeks (i.e., soil will be removed and disposed of offsite within approximately 5 weeks). During this period, the ABG daily operations may be affected because of the excavation activities and transportation of the excavated material offsite. The environmental footprint of Alternative 2 is primarily driven by impacts associated with borrow pit operations for backfill and transportation of fill and waste to and from the site the offsite disposal of the excavated material. Onsite labor hours during construction activities accounted for the majority of the accident risk injury footprint with contributions from transportation, of both personnel and equipment and materials including waste. Transportation and onsite labor hours each contributed evenly to the accident risk fatality footprint.
Implementability	Alternative 1 does not have a monitoring or construction component; therefore, there are no issues concerning its technical feasibility. However, The administrative implementability of this alternative is low in terms of its ability to obtain approvals from regulatory agencies.	Excavation and offsite disposal are technically feasible. The administrative implementability of this alternative is high in terms of its ability to obtain approvals from regulatory agencies. Implementation of any remedy within the ABG must comply with scheduling requirements set forth by ATK and ensure the mission critical activities in this area are met.
Cost	$0	Capital: $718,695 Present Worth O&M: $0 Total Present Worth: $718,695 Cost is based on 0-year operation timeframe. All LTM will be addressed under the current groundwater LTM under OU-3.

Table 5-3
Comparative Analysis of Remedial Alternatives for the OABG
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

<table>
<tr><th>Evaluation Criteria</th><th>Alternative 1
No Action</th><th colspan="2">Alternative 2
Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt</th><th colspan="2">Alternative 3
Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs, and LTMgt</th></tr>
<tr><td>Overall Protection of Human Health and the Environment</td><td>Not protective of human health and the environment.</td><td colspan="2">This alternative satisfies the protection of human health and environment criterion because soil that may represent a potential source of contamination will be excavated and removed from the site. The RAOs, and therefore the SRGs, would be achieved immediately after construction completion.</td><td colspan="2">This alternative satisfies the protection of human health and environment criterion because soil that may represent a potential source of contamination will be excavated, treated, and removed from the site. The RAOs, and therefore the SRGs, would be achieved immediately after construction completion.</td></tr>
<tr><td>Compliance with ARARs</td><td>This alternative does not meet the applicable chemical- and location-specific ARARs. There are no applicable action-specific ARARs because no remedial actions would be undertaken with this remedial alternative.</td><td colspan="2">This alternative would comply with the action-, location-, and chemical-specific ARARs identified in Appendix C. For example, the chemical-specific ARARs would be met by eliminating soil-to-groundwater leaching of COCs, and the action-specific disposal controls would be met through soil characterization and appropriate disposal. The location-specific ARARs with regard to the floodplain would be met through erosion controls and appropriate grading.</td><td colspan="2">This alternative would comply with the action-, location-, and chemical-specific ARARs identified in Appendix C. For example, the chemical-specific ARARs would be met by eliminating soil-to-groundwater leaching of COCs, and the action-specific disposal controls would be met through soil characterization, treatment, and appropriate disposal. The location-specific ARARs with regard to the floodplain would be met through erosion controls and appropriate grading.</td></tr>
<tr><td>Long-Term Effectiveness and Permanence</td><td>Alternative 1 does not provide long-term effectiveness and permanence. There would be no prevention of direct contact with the soil COCs, and no reduction in risk to human receptors, ecological receptors, or soil-to-groundwater leaching under this alternative.</td><td colspan="2">Because sources of soil contamination would be permanently removed from the site, Alternative 2 would reduce the residual risks associated with the COCs to acceptable levels at the site and would satisfy the long-term effectiveness and permanence criteria.

Emissions (NOx, PM10, and carbon dioxide associated with GHG and criteria pollutants) from transportation and heavy machinery use persist for an extended period after RAOs are achieved. Quantity of emissions is relatively higher than in Alternative 1 but lower than Alternative 3, with the exception of PM10 which is slightly higher for Alternative 2.</td><td colspan="2">Because sources of soil contamination would be permanently removed from the site, Alternative 3 would reduce the residual risks associated with the COCs to acceptable levels at the site and would satisfy the long-term effectiveness and permanence criteria.

Emissions (NOx, PM10, and carbon dioxide associated with GHG and criteria pollutants) from transportation and heavy machinery use persist for an extended period after RAOs are achieved. Quantity of emissions is relatively higher than in Alternatives 1 and 2, with the exception of PM10 which is slightly higher for Alternative 2.</td></tr>
<tr><td>Reduction of Toxicity, Mobility, or Volume Through Treatment</td><td>Alternative 1 does not include treatment.</td><td colspan="2">Alternative 2 does not include treatment. However, this alternative would ultimately reduce the toxicity, mobility, and volume of contaminants through removal of the contaminated soil and disposal to appropriately permitted facilities.</td><td colspan="2">This alternative includes ex situ treatment of contaminated soil to meet non-hazardous disposal requirements. This alternative would ultimately address toxicity, mobility, and volume of contaminants at the site through removal of the contaminated soil and debris to an appropriately permitted facility.</td></tr>
<tr><td>Short-Term Effectiveness</td><td>There is no construction associated with Alternative 1; therefore, there are no short-term impacts on workers, the community, or the environment. However, the RAOs and, therefore, the SRGs cannot be achieved.</td><td colspan="2">Under Alternative 2, RAOs would be met within approximately 24 weeks (i.e., soil will be removed and disposed of offsite within approximately 24 weeks). No periodic operations at the OABG would be affected because of the excavation and treatment activities; however overall ABL activities may be periodically disrupted through transportation of the excavated/treated material through the facility and offsite.

The environmental footprint of Alternative 2 is primarily driven by the offsite disposal of the excavated material, including transportation of waste to hazardous and non-hazardous landfills. The potential accident risk, both fatality and injury footprints, for Alternative 2 was primarily driven by waste the personnel transportation with lesser contributions from personnel and fill transportation and onsite labor hours. required during the excavation and disposal of waste.</td><td colspan="2">Under Alternative 3, RAOs would be met within approximately 33 weeks (i.e., soil will be removed and disposed of offsite within approximately 33weeks). No periodic operations at the OABG would be affected because of the excavation and treatment activities; however overall ABL activities may be periodically disrupted through transportation of the excavated/treated material through the facility and offsite.

The environmental footprint of Alternative 3 is primarily driven by fuel use for the ex situ thermal treatment and handling of the excavated material. The potential accident risk for Alternative 3 is primarily driven by onsite labor hours and fill and waste transportation the personnel transportation required during the excavation and residue/recycling of waste .</td></tr>
<tr><td>Implementability</td><td>Alternative 1 does not have a monitoring or construction component; therefore, there are no issues concerning its technical feasibility. However, The administrative implementability of this alternative is low in terms of its ability to obtain approvals from regulatory agencies.</td><td colspan="2">Removal of surface debris, excavation and offsite disposal are technically feasible. The administrative implementability of this alternative is high in terms of its ability to obtain approvals from regulatory agencies. Implementation of any remedy within the OABG must comply with scheduling requirements set forth by ATK and ensure the mission critical activities within the ABG area are met.</td><td colspan="2">Removal of surface debris, excavation, ex situ thermal treatment of TCE, and offsite disposal are technically feasible. The administrative implementability of this alternative is high in terms of its ability to obtain approvals from regulatory agencies. Implementation of any remedy within the OABG must comply with scheduling requirements set forth by ATK and ensure the mission critical activities within the ABG area are met.</td></tr>
<tr><td rowspan="4">Cost</td><td rowspan="4">$0</td><td>Capital:</td><td>$10,194,241</td><td>Capital:</td><td>$8,334,872</td></tr>
<tr><td>Present Worth O&M:</td><td>$141,249</td><td>Present Worth O&M:</td><td>$141,249</td></tr>
<tr><td>Total Present Worth:</td><td>$10,335,490</td><td>Total Present Worth:</td><td>$8,476,121</td></tr>
<tr><td colspan="2">Cost is based on 30-year operation time frame assumption.</td><td colspan="2">Cost is based on 30-year operation time frame assumption.</td></tr>
</table>

Table 5-4
Preliminary Remediation Cost Summary for the ABG
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Remedial Alternative	Description	Construction Time (weeks)	Operation Time (years)	Capital Cost	Present Worth O&M Costs	Total Present Worth
1	No Action	0	0	$0	$0	$0
2	Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt	5	0	$718,695	$0	$718,695

Table 5-5
Preliminary Remediation Cost Summary for the OABG
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Remedial Alternative	Description	Construction Time (weeks)	Operation Time (years)	Capital Cost	Present Worth O&M Cost	Total Present Worth
1	No Action	0	0	$0	$0	$0
2	Removal of Surface Debris, Excavation or AOCs, Offsite Disposal, LUCs, and LTMgt	24	30	$10,194,241	$141,249	$10,335,490
3	Removal of Surface Debris, Excavation or AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt	33	30	$8,334,872	$141,249	$8,476,121

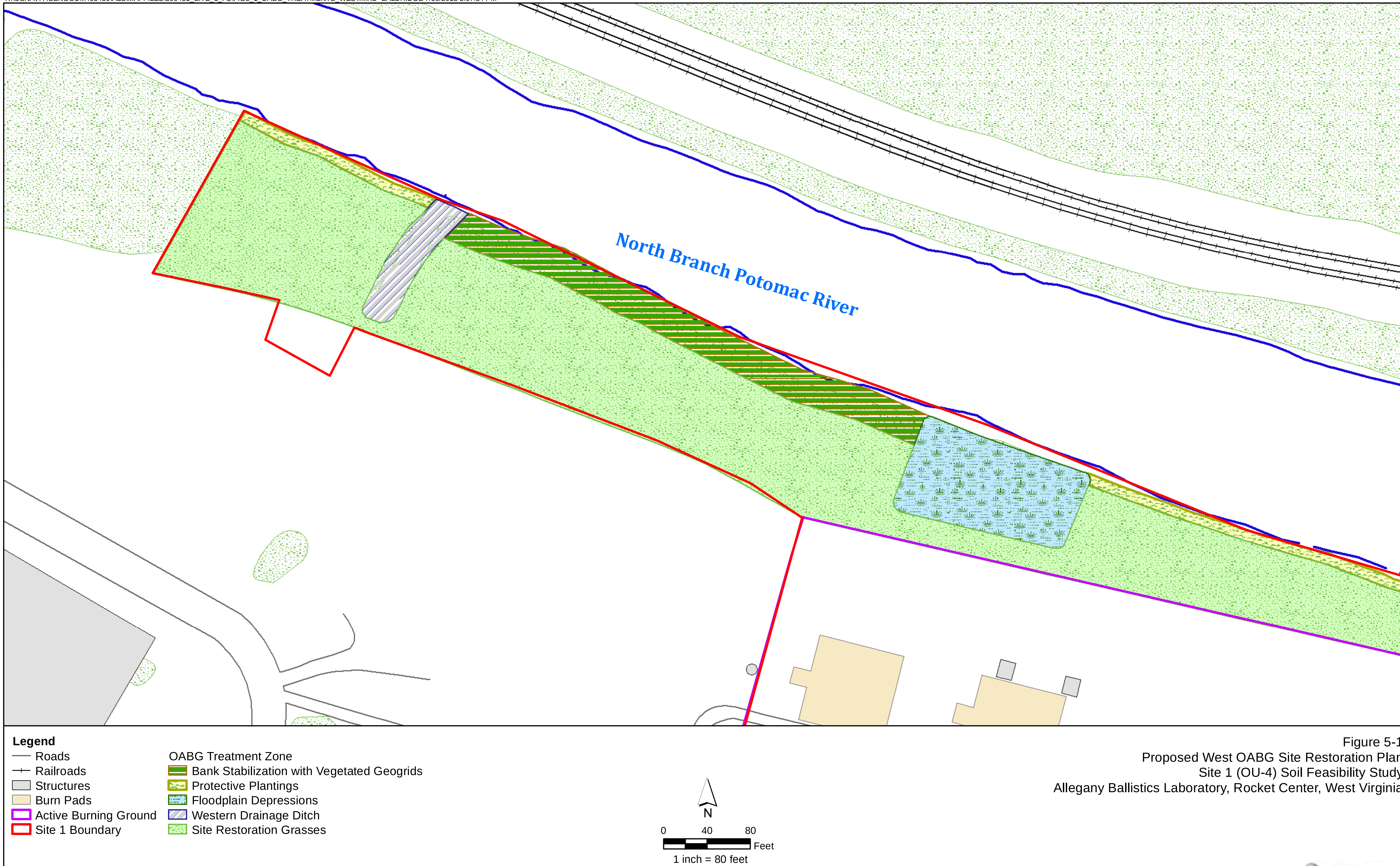

Figure 5-1
Proposed West OABG Site Restoration Plan
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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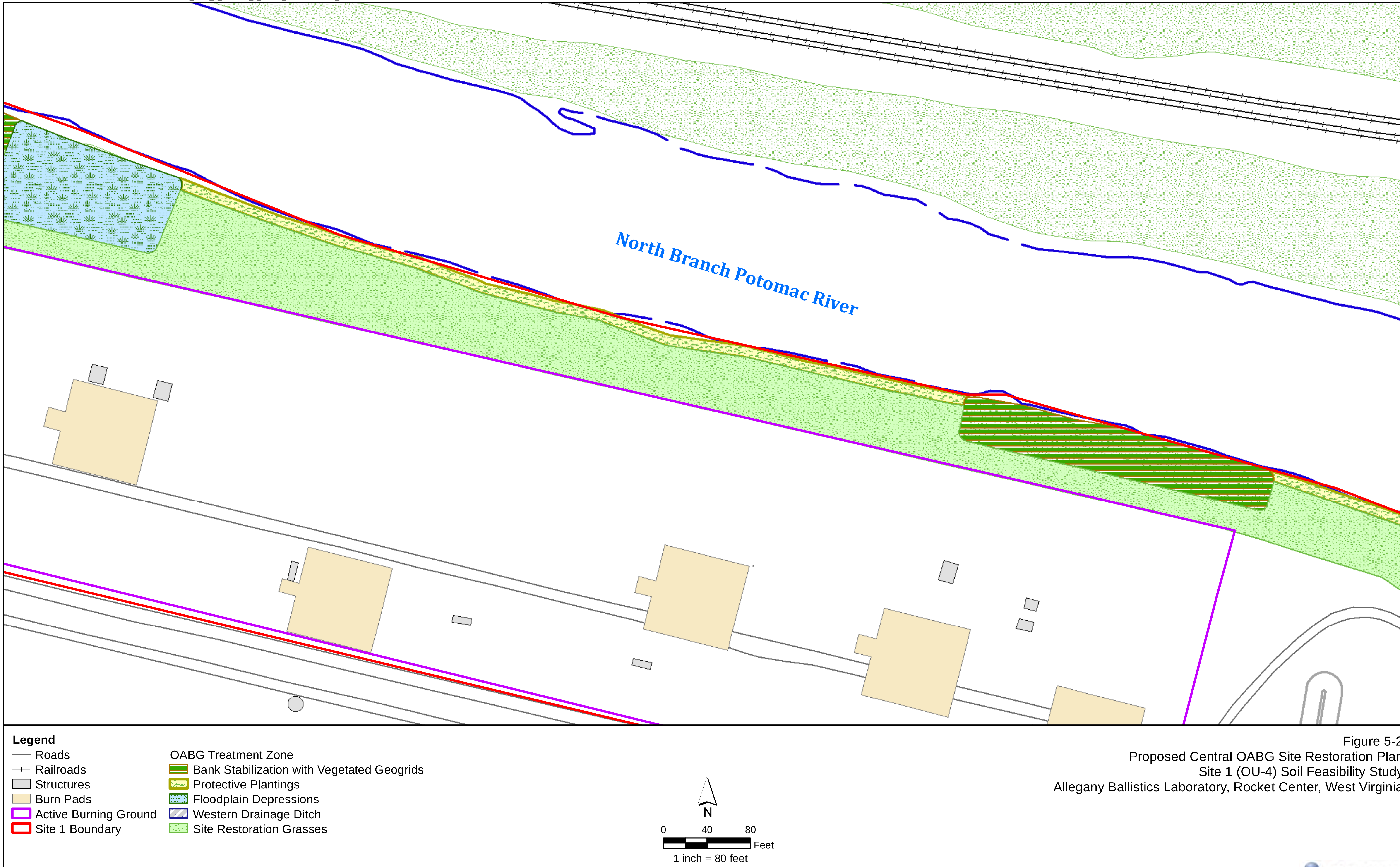

Figure 5-2
Proposed Central OABG Site Restoration Plan
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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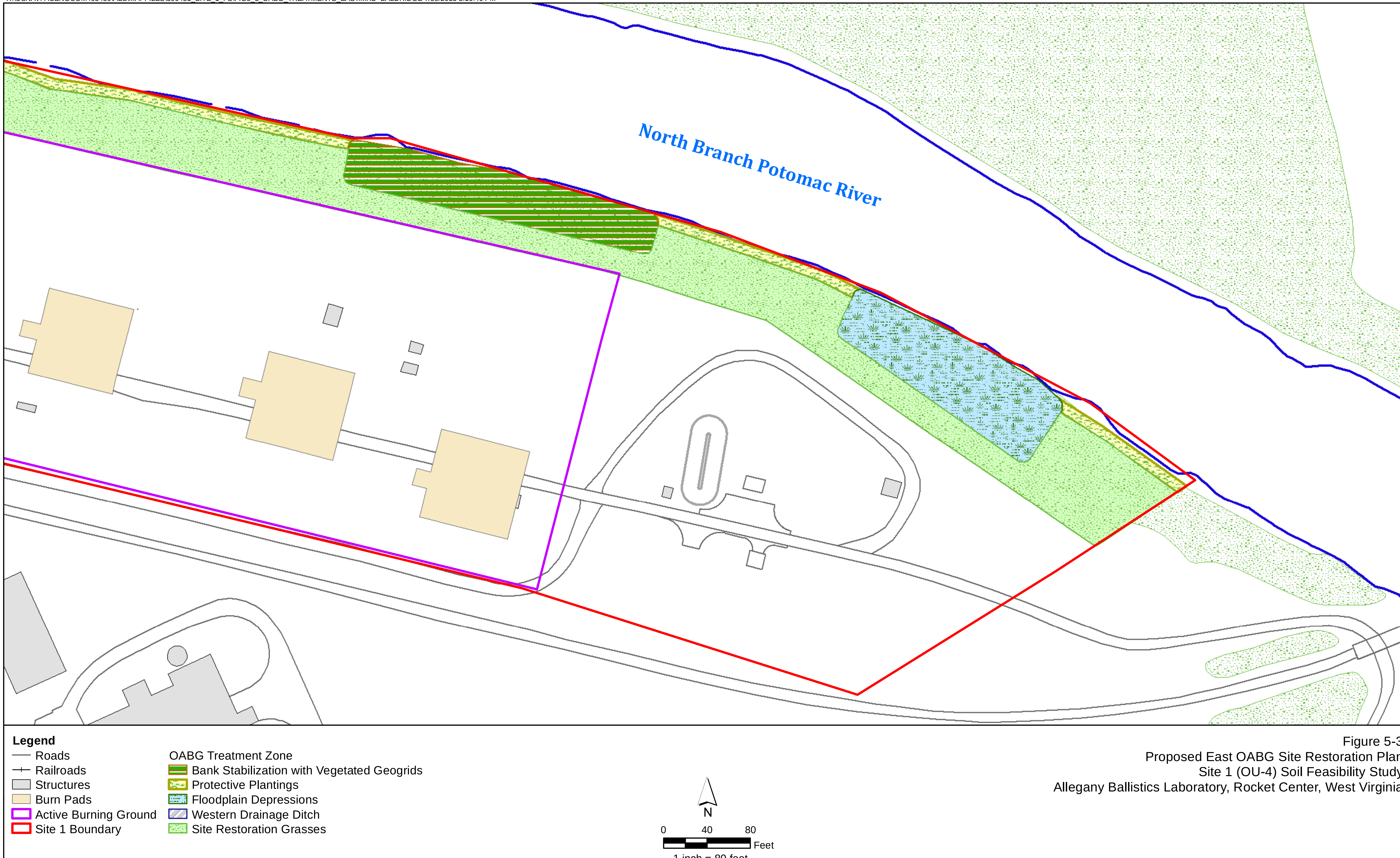

Figure 5-3
Proposed East OABG Site Restoration Plan
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

ABL Site 1 OABG Western Drainage Ditch, January 2012


Example step pool series using boulder cross vanes

Figure 5-4
Example Restoration Strategy for Western Drainage Ditch
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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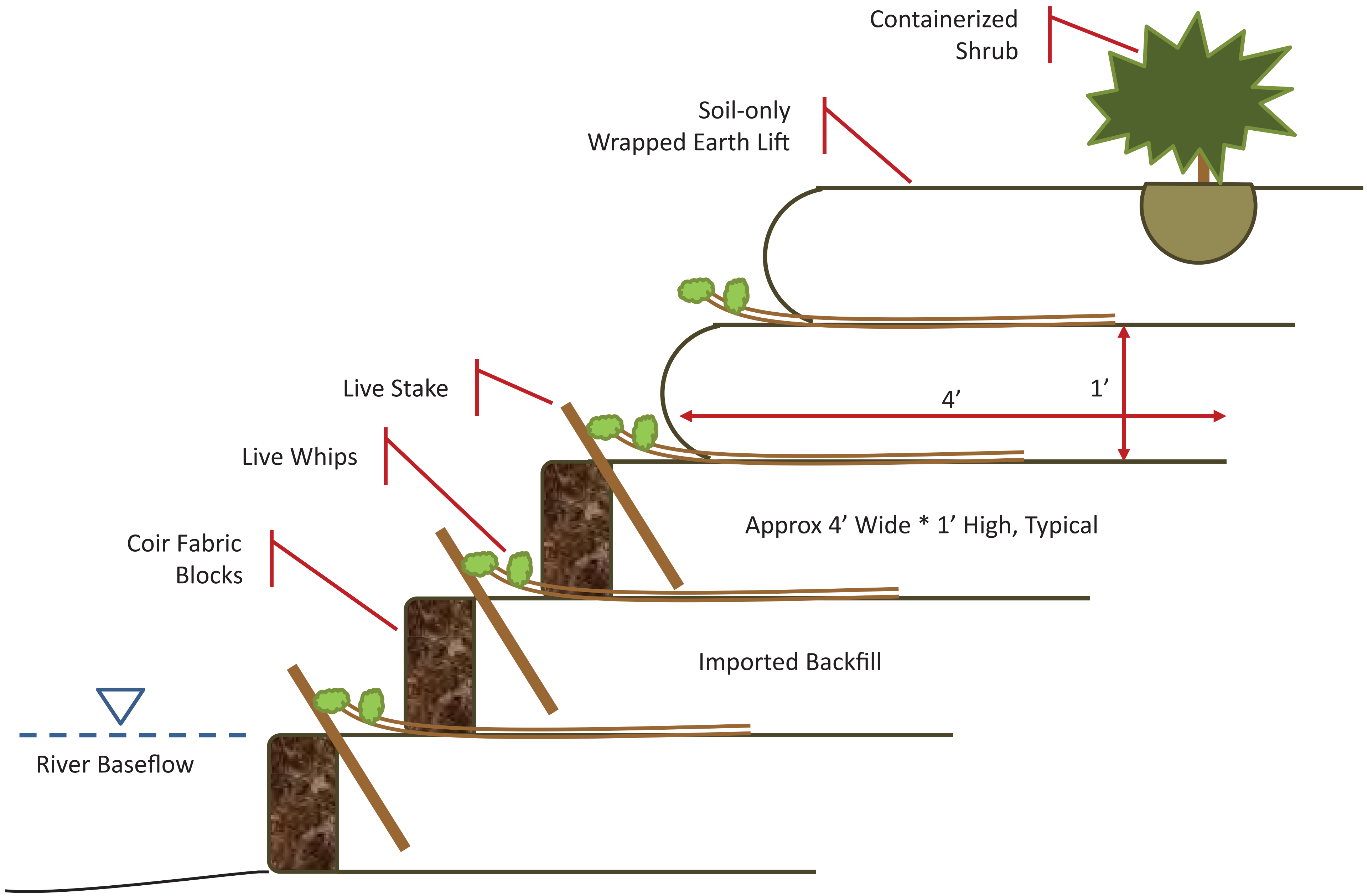

Example vegetated geogrids (section view)

ABL Site 1 OABG river bank, January 2012

Example of vegetated geogrids

Figure 5-5
Example Restoration Strategy for Bank Stabilization with Vegetated Geogrids
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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ABL Site 1 OABG, January 2012


Example floodplain depression

Figure 5-6
Example Restoration Strategy for Floodplain Depressions
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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ABL Site 1 OABG, January 2012

Example of sprouted live stake planting

Example of live stake installation on riverbank

Figure 5-7
Example Restoration Strategy for Protective Plantings
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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ABL Site 1 OABG 25-foot buffer area, March 2009

Example of native grass blend

Figure 5-8
Example Restoration Strategy for Site Restoration Grasses
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

- How Alternatives Provide Human Health and Environmental Protection

COMPLIANCE WITH ARARs

- Compliance With Chemical-Specific ARARs
- Compliance With Action-Specific ARARs
- Compliance With Location-Specific ARARs
- Compliance With Other Criteria, Advisories, and Guidance (TBC Guidance)

LONG-TERM EFFECTIVENESS AND PERMANENCE

- Magnitude of Residual Risk
- Adequacy and Reliability of Controls

REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

- Treatment Process Used and Materials Treated
- Amount of Hazardous Materials Destroyed or Treated
- Degree of Expected Reductions in Toxicity, Mobility, and Volume
- Degree to Which Treatment is Irreversible
- Type and Quantity of Residuals Remaining After Treatment

SHORT-TERM EFFECTIVENESS

- Protection of Community During Remedial Construction
- Protection of Workers During Remedial Construction
- Environmental Impacts
- Time Until Remedial Action Objectives Are Achieved

IMPLEMENTABILITY

- Ability to Construct and Operate the Technology
- Reliability of the Technology
- Ease of Undertaking Additional Remedial Action, if Necessary
- Ability to Monitor Effectiveness of Remedy
- Ability to Obtain Approvals From Other Agencies
- Coordination With Other Agencies
- Availability of Off-site Treatment, Storage, and Disposal Services and Capacity
- Availability of Necessary Equipment, Materials, and Personnel
- Availability of Prospective Technologies

COST

- Capital Costs
- Operating and Maintenance Costs
- Present Worth Cost

STATE [(1)] ACCEPTANCE

COMMUNITY [(1)] ACCEPTANCE

[1] These criteria are assessed following comment on the FS and the Proposed Plan.

Figure 5-9
Detailed Evaluation Criteria
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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SECTION 6

Summary and Conclusions

Based on findings of the Site 1 RI (CH2M HILL, 2006a), a FS was performed to develop RAOs, ARARs, PRGs, and SRGs; develop and screen remedial technologies; and develop site-specific remedial alternatives for Site 1 soil. In order to address potential risks and ARARs associated with Sites 1 soil, two remedial alternatives were developed for the ABG and three remedial alternatives were generated for the OABG:

- ABG
  - Alternative 1 – No Action
  - Alternative 2 – Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
- OABG
  - Alterative 1 – No Action
  - Alternative 2 – Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
  - Alternative 3 – Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt

These alternatives were compared using the following NCP criteria:

- Protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Two additional criteria, state acceptance and community acceptance, will be addressed in the Proposed Plan and ROD for Site 1 soil. Table 6-1 and Table 6-2 summarize how each alternative satisfies each criterion and how it compares to the other alternatives for the ABG and OABG, respectively. Following completion of the FS, a preferred alternative that best satisfies the RAOs will be presented in a Proposed Plan and will be submitted for public review and comment. The resulting comments will be reviewed, and a remedy will be selected and formally documented in an ROD.

Table 6-1
Comparative Analysis Measles Chart of Remedial Alternatives for the ABG
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Criteria	Alternative 1	Alternative 2
Overall Protectiveness of Human Health and the Environment	○	●
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	○	●
Long-Term Effectiveness and Permanence	○	●
Reduction of Toxicity, Mobility or Volume Through Treatment	○	○
Short-Term Effectiveness	○	●
Implementability	●	●
Cost[1]	$0	$718,695

Ranking: ● Satisfies criterion ◎ Moderately satisfies criterion ○ Poorly satisfies criterion

Alternative 1 – No Action
Alternative 2—Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt

[1] Cost is the total present worth value; Cost accuracy ranges from -30% to +50%.

Table 6-2
Comparative Analysis Measles Chart of Remedial Alternatives for the OABG
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Criteria	Alternative 1	Alternative 2	Alternative 3
Overall Protectiveness of Human Health and the Environment	○	●	●
Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)	○	●	●
Long-Term Effectiveness and Permanence	○	●	●
Reduction of Toxicity, Mobility or Volume Through Treatment	○	○	●
Short-Term Effectiveness	○	●	●
Implementability	●	●	●
Cost[1]	$0	$10.34	$8.48

Ranking: ● Satisfies criterion ◉ Moderately satisfies criterion ○ Poorly satisfies criterion

Alternative 1 – No Action
Alternative 2 – Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt

Alternative 3 – Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt

[1] Cost is the total present worth value ($Million); Cost accuracy ranges from -30% to +50%.

SECTION 7

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Appendix A
SRG Selection Process and Evaluation of Target Remediation Areas Technical Memorandum

005_CTO_0046_0.5in.indd

Revised Final Technical Memorandum

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory
Rocket Center, West Virginia

Naval Facilities Engineering Command

Prepared for

Department of the Navy

Naval Facilities Engineering Command
Mid-Atlantic

1000

Contract No.
N62470-08-D-1000
CTO-046

February 2013

Prepared by

CH2MHILL

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1, Allegany Ballistics Laboratory, Rocket Center, West Virginia

PREPARED FOR:	Allegany Ballistics Laboratory Tier I Partnering Team
COPY TO:	Allegany Ballistics Laboratory Tier II Partnering Team
PREPARED BY:	CH2M HILL
DATE:	February 15, 2013
PROJECT NUMBER:	383540.FS.FR

Introduction

This technical memorandum presents the proposed site remediation goals (SRGs) and method for applying a 95 percent upper confidence limit (UCL) of site-wide soil concentrations within the active burning ground (ABG) and outside active burning ground (OABG) to determine areas of concern (AOCs) that will be targeted for remediation in Operable Unit (OU) 4, Site 1 soil, at Allegany Ballistics Laboratory (ABL) located in Rocket Center, West Virginia. The human health and ecological preliminary remediation goals (PRGs) and site-specific soil-to-groundwater leaching considerations discussed herein supersede previous partnering team discussions and decisions regarding Site 1 SRGs.

The Department of the Navy (Navy), in partnership with West Virginia Department of Environmental Protection (WVDEP) and the United States Environmental Protection Agency (EPA), will utilize the AOCs presented in this memo to define the general AOCs in soil for use as part of the remedial alternative development and comparison in the Feasibility Study (FS). This technical memorandum does not address how the post-remedial-action confirmation sampling will be interpreted or how the remedial goals will be used in the field if an excavation alternative is selected as the final remedy. Furthermore, additional data collection efforts may be necessary to refine remedial target areas presented in this memorandum prior to selection of the final remedy, which will be presented in the Record of Decision (ROD) in accordance with the Navy's Environmental Restoration Program, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance (EPA, 1999), the National Oil and Hazardous Substance Pollution Contingency Plan (Title 40 Code of Federal Regulations Part 300 et seq.), and other relevant EPA guidance.

Site Description

Site 1 is an 11-acre area situated adjacent to the North Branch Potomac River along the northern border of the developed portion of Plant 1 at ABL. Site 1 has been used for various types of waste burning and historical disposal activities. Site 1 groundwater, surface water, and sediment were investigated as part of a separate OU (OU-3) with a final ROD signed in May 1997 (CH2M HILL, 1997). Site 1 soil (OU-4), which is the subject of this memorandum, comprises the ABG and OABG, as shown on Figure 1.

Active Burning Ground

The ABG consists of several historical disposal units within an 8-acre parcel used for burning reactive wastes and is regulated under a Resource Conservation and Recovery Act (RCRA) permit. A 6-foot-tall locked fence surrounds the area, which is mostly covered by mowed grass. An asphalt road spans the east-west length of the fenced area.

Historical disposal of spent acid and solvents occurred in three former disposal pits (FDPs), located inside the boundary of the ABG, and are considered primary sources of contamination to groundwater. An Engineering Evaluation and Cost Analysis and Action Memorandum have been developed to address these potential sources of groundwater contamination in the unsaturated soil (CH2M HILL, 2012).

Eight earthen burn pads, operated from 1959 until the mid-1990s, were used to burn solvents and explosive waste generated at ABL. The burn pads were numbered 1 through 8, going from east to west. During operations, each burn pad reportedly handled specific types of wastes, which included explosives, solid propellants, and reactive solvents. The former earthen burn pads are not currently used and have been overgrown with vegetation. Currently, open burning occurs on six large concrete burn pads, labeled Pad A through Pad F, going from east to west. Although the ABG is operating under a RCRA permit, it was agreed upon by the Partnering Team in April 2009 that this area potentially includes contamination attributed to historical waste burning; therefore, the ABG will be considered for remedial action under CERCLA.

Outside Active Burning Ground

The OABG was historically used for various waste disposal activities that no longer occur. Based on historical activities, the OABG has been divided into the following subareas:

- **West OABG** - Former open burn area and associated disposal area, located in the northwest portion of the site. It consists of the former open burn area, former burn cages, and western drainage ditch. The former open burn area was enclosed behind a chain link fence where the solid wastes were burned. The resulting ash was spread along the lower floodplain area in a portion of the former open burn disposal area. Demolition debris, concrete rubble, drums, and rocket casings were also disposed in the former open burn disposal area. The western drainage ditch is an earthen drainage culvert that cuts through the disposal area and drains surface water and stormwater from Plant 1. Debris materials, including ash buried during successive disposal events, are exposed in the walls of this culvert. Surface debris is also present throughout and to the east of the former open burn disposal area, some of which was removed in 2008.

- **Central OABG** - As reported in the 2008 debris characterization technical memorandum (CH2M HILL, 2008), no evidence of debris or disposal activities in this area was encountered through visual observation or subsurface soil sampling.

- **East OABG** - Former inert burn area and associated disposal area along the river, located in the northeastern portion of the site. The former inert burn area lies east of the perimeter fence surrounding the ABG area. Ash from burning in this area was spread and buried during successive disposal events.

Summary of Site Risks

A quantitative human health risk assessment (HHRA) and ecological risk assessment (ERA) were conducted during the focused Remedial Investigation (RI) for soil within the ABG and OABG (CH2M HILL, 2006). In addition, an evaluation of the potential for constituents to leach from soil to groundwater at levels posing a potentially unacceptable risk was completed for Site 1 soils and is documented herein. Data collected between 1992 and 2004 were included in the risk assessments and soil-to-groundwater leaching evaluation.

Human Health Risk Assessment Summary

The baseline HHRA was conducted to evaluate the potential human health risks associated with surface soil and combined soil (surface and subsurface soil) at the ABG, FDP (addressed separately from the ABG in the RI), and OABG. Potential risks were calculated for current/future industrial worker, adolescent trespasser/visitor, adult recreational person, and adolescent recreational person, as well as for future adult resident, child resident, lifetime resident, and construction worker. Constituents of concern (COCs) were selected as those chemicals contributing individual cancer risks above 10^{-6} to total cancer risks for a potential human receptor that were above 10^{-4} or contributing individual non-carcinogenic hazards above 0.1 to total hazard indices for a potential receptor above 1.0. No unacceptable risks associated with exposure to surface soil were identified, as evaluated for current exposure scenarios. The only unacceptable risk was associated with exposure to combined soil by future residents. A summary of site risks associated with each receptor scenario is provided in Table 1.

Ecological Risk Assessment Summary

The baseline ERA (BERA) was conducted to evaluate the potential ecological risks associated with surface soil at the ABG, FDP, and OABG. Because of their proximity and similarity in habitat, the ABG and FDP areas were addressed together and referred to as "upland habitat." Because most of the OABG area is within the floodplain of the river, this area was referred to as "floodplain habitat." The terrestrial portion of the ERA was quantitatively conducted using surface soil samples collected from the top foot of the soil column because this depth range represented the most realistic potential exposures for most of the ecological receptors evaluated in terrestrial habitats. Because some ecological receptors may be exposed, at least periodically, to deeper soils, available subsurface soil data from the 12- to 24-inch depth interval (a few samples that extended down to 3 feet were also used) were also qualitatively considered to determine if constituent concentrations in the subsurface layers were higher than in surface layers.

Potential risks were evaluated for lower trophic level receptors (terrestrial plants and soil invertebrates for direct exposures to surface soil) and for upper trophic level receptors (birds and mammals, for food web exposures). Laboratory toxicity tests (bioassays) were conducted using split samples of surface soil collected from floodplain areas of the site. Earthworms were the test organism and a total of 15 tests were conducted, two of which were from reference areas. Earthworm tissue samples from five of these samples (four site samples and one reference sample) were analyzed for dioxins/furans following completion of the toxicity tests.

Surface soil COCs were selected based upon a comparison of site surface soil concentrations to literature-based soil screening values and site-specific background concentrations (CH2M HILL, 2004), the results of soil toxicity testing, and the results of food web modeling. A summary of site risks associated with ecological receptor exposure is provided in Table 2.

For upland areas, potential unacceptable risks were associated with direct exposure to several metals and explosive compounds in surface soil. Baseline risk estimates using area-wide averages indicated low to negligible risks for upper trophic level receptors in upland habitats. The upland portion of Site 1 is covered with periodically mowed grasses and other herbaceous plants, providing habitat of limited diversity and quality. Except for unpaved roads and the areas immediately around some of the active burn pans, no obvious phytotoxic effects (for example, large areas of bare soil or dead or dying plants) were observed. Given the limited habitat quality of the ABG area, particularly in the vicinity of the active burn pads where most of the significant exceedances were found, concentrations of the metal and explosive COCs are not likely to result in adverse impacts to populations of ecological receptors.

For floodplain areas, potential unacceptable risks were associated with direct exposures to several metals, explosives, volatile organic compounds, and polycyclic aromatic hydrocarbons (PAHs) in surface soil. The highest concentrations of these constituents generally occurred in the vicinity of the former open burn area, the western drainage ditch, and in the vicinity of the former inert burn area. Several of these samples consisted mostly of ash rather than soil. PAH concentrations were elevated in several samples clustered on or near the banks of the western drainage ditch. At two of these locations, PAHs were identified as potentially responsible for soil invertebrate toxicity. Trichloroethene and 1,2-dichloroethene exceeded screening values in the vicinity of the former inert burn area. Mercury was the only constituent with an exceedance based on the lowest observed adverse effect level (LOAEL) for terrestrial-based food web exposures in the OABG area. In addition to mercury, hazard quotients (HQs) exceeded 1.0 based upon the maximum acceptable toxicant concentration (MATC) for cadmium (short-tailed shrew), lead (American robin), zinc (American robin), and dioxin/furans (long-tailed weasel).

The results of the soil toxicity test were generally consistent with the results from the surface soil screening. The most-impacted samples, which had a mean survival of less than 25 percent and little if any signs of reproduction, were associated with the locations in the former open burn area, the western drainage ditch, and the former inert burn area.

Site-Specific Soil Screening Levels

Site-specific soil screening levels (SSLs) were developed to evaluate COC concentrations in soil that are protective of the uppermost groundwater-bearing unit. The approach used to develop the SSLs follows EPA's *Soil Screening Guidance* (EPA, 1996) and the *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (EPA, 2002). The basis of the approach is that infiltrating precipitation leaches the contaminants from the soil and transports them into the aquifer, and is then diluted by the lateral flow within the aquifer. The approach assumes that a hypothetical future groundwater user is present on the immediate downgradient boundary of the site. Potable groundwater use is assumed for the hypothetical future scenario for the Site 1 SSL evaluation.

Procedure for Calculating Soil Screening Levels

The SSLs are based on an equilibrium partitioning equation that assumes chemicals in the subsurface are in equilibrium between the solid, liquid and gaseous phases present in the vadose zone. Therefore, the chemicals in the vadose zone may exist in three states: sorbed to soil particles, dissolved in the soil moisture, and in a gaseous phase in the air-filled soil pores. This approach also assumes that the soil moisture (leachate) will migrate downward to the underlying water table. Typically, lateral groundwater flux within the underlying aquifer is much greater than the vertical recharge and a dilution attenuation factor (DAF) has been used in calculating the SSL. The groundwater protection standard (target leachate concentration [C_w]) is the product of the potable groundwater standard (maximum contaminant level [MCL] or regional screening level [RSL]) and the DAF. The C_w is the diluted standard. The input parameters to the SSL equilibrium equation and DAF equation are listed in Table 3.

SSLs were calculated using: $$SSL = C_w \times \left[K_d + \frac{(\theta_w + \theta_a H')}{\rho_b} \right]$$

DAF was calculated using: $$DAF = 1 + \frac{Kid}{IL}$$

Perchlorate does not readily sorb to soil particles, nor does it partition to soil gas; therefore, a different approach was used to evaluate an SSL. EPA's *Soil Screening Guidance* document provides a conservative estimate for an SSL providing that all of contaminant mass leaches from the soil into the underlying groundwater. The input parameters to the SSL equilibrium equation are listed in Table 4.

The mass limit SSL for perchlorate was calculated using:

$$SSL = \left(\frac{C_w \times I \times ED}{\rho_b \times d_s} \right) \left(\frac{1}{12} \frac{ft}{in} \right)$$

Tables 5 and 6 summarize the SSLs for COCs that exceeded the site-specific background concentrations (as applicable) in the ABG and OABG, respectively. For each constituent, SSLs were calculated using the DAF of 46 (site-specific factor for the ABG) and 236 (site-specific factor for the OABG).

Preliminary Remediation Goals and Soil-To-Groundwater Leaching Considerations

PRGs were calculated for both human health and ecological exposure scenarios, for the COCs identified for ABG and OABG based on their respective risk assessments. As previously noted, human health COCs were identified for only the residential land use scenario. However, PRGs were calculated for all human health COCs to ensure concentrations of COCs remaining onsite would be below levels to allow for industrial land use. Supporting calculations for the human health and ecological risk-based PRGs are presented in Attachments A and B, respectively.

Site-specific soil-to-groundwater leaching considerations presented as SSLs are model-generated values based on a number of assumptions, which include a uniform distribution of COCs across the entire site and no degradation (abiotic or biotic) of the chemicals during either vertical or horizontal transport through the vadose zone and the aquifer. Therefore, leachate concentrations may either be over or underestimated. In an effort to determine how the SSLs will be applied during SRG development, the Navy, in partnership with WVDEP and EPA, agreed that an evaluation of SSLs with respect to groundwater concentrations across the site is warranted.

The PRGs and SSL considerations for the ABG and OABG are presented in Tables 7 and 8, respectively.

Human Health Risk-Based Preliminary Remediation Goals

Human health risk-based PRGs were calculated for industrial site use, and although unlikely, a potential future residential land use for the site. Residential PRGs were calculated for a child resident (based on a target non-carcinogenic hazard) and a lifetime (child/adult) resident (based on a target cancer risk) (Attachment A, Tables 4 through 10). Industrial site use PRGs were calculated for an industrial worker and a construction worker (Attachment A, Tables 11 through 25). PRGs were not calculated for the adolescent trespasser because the potential risks for this receptor are lower than those for the industrial worker; so levels protective of industrial worker are protective of future recreational users (CH2M HILL, 2006).

The equations presented in EPA's *Risk Assessment Guidance for Superfund Volume 1, – Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals* (EPA, 1991) were re-arranged into one equation to incorporate the ingestion, dermal absorption, and inhalation pathways to calculate one PRG per constituent for exposure to soil for each of the scenarios evaluated (Attachment A**,** Tables 4 through 9 and 11 through 24). The method used to calculate the contribution from inhalation to the PRG was updated to be consistent with EPA's *Risk Assessment Guidance for Superfund Volume 1: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment* (EPA, 2009). As previously stated, PRGs were calculated for both the residential scenario and the industrial scenario for the constituents that were identified as COCs in the Focused RI HHRA. The exposure assumptions used in the PRG calculation equations are the same as those used in the Focused RI HHRA (Table 4 in Appendix D of the Focused RI), with a few exceptions. These exceptions are based on comments received from EPA on the proposed remedial action objectives and remedial goals for Site 1 soil received via email from Sun Yi, EPA, on August 4, 2008 (EPA, 2008), and include the construction worker soil ingestion rate and construction worker inhalation rate, which have been updated to reflect recommended values (Attachment A, Tables 17 through 24). The toxicity values, non-cancer reference doses and cancer slope factors used to calculate the PRGs for the COCs were compared to current toxicity values and have also been updated if more recent values were available.

The HHRA PRGs for residential and industrial land use at the ABG, FDPs, and OABG at Site 1 are summarized in Tables 1, 2, 3, and Attachment A. The target non-carcinogenic hazard for each constituent for each area was determined based on the number of constituents that result in an effect on the same target organ or system (for example, the gastrointestinal system). For example, assuming that an acceptable hazard is 1.0, if two constituents affect the same target organ or system, the target noncarcinogenic hazard for those constituents would be 0.5; therefore the PRG value will be lower than the threshold value of hazard index=1.0. The target carcinogenic risk for each constituent for each area was set equal to 10^{-5} in order to be protective by ensuring that the total cancer risk associated with exposure to the soil would not exceed 10^{-4}. The lower of the PRG based on non-cancer or cancer endpoints was chosen as the human health risk-based PRG for the COC.

Ecological Risk-Based Preliminary Remediation Goals

Soil PRGs based on various ecological effect levels were developed for the Site 1 ecological soil COCs identified in the BERA contained in the soil RI (CH2M HILL, 2006). The development of these PRGs considered the following:

- Soil screening values used in the BERA, updated as appropriate
- Alternate soil screening values from the literature
- Background upper tolerance limit values from the facility-wide background study and maximum concentrations in site-specific reference soil samples
- No observed effect concentration (NOEC) values from surface soil toxicity testing; these values were calculated as follows:
  - Survivorship NOECs were calculated as the maximum concentration in samples that did not have a significant reduction in survivorship as compared to the control
  - Reproduction NOECs were calculated as the maximum concentration in samples that showed signs of reproduction

  - Growth NOECs were not calculated because growth appeared dependent upon the survivorship, with larger worms observed in samples with lower survivorship, and smaller worms observed in samples with higher survivorship

- Back-calculated food web exposure values (from a HQ of 1.0) using facility-specific soil-to-earthworm bioaccumulation factors (geometric mean values), where available, and ingestion-based screening values (based on the LOAEL). The most sensitive receptors were selected for this calculation (based on the HQs from the BERA). Input parameter values and ingestion-based toxicity reference values were the same as those used in the BERA. Although the MATC was used as the threshold to select food web COCs in the BERA (RI), mean surface soil concentrations were also used as the exposure point concentration during the COC selection process. Because the PRGs are used in the FS as risk-management values (that is, based on a 95 percent UCL concentration), using either the NOAEL or MATC to develop the PRGs for food web COCs may result in overly conservative values. For this reason, the PRGs for food web COCs were based on the LOAEL.

The selected ecological PRGs are summarized in Attachment B, Table B.1, and the derivation of these values is provided in Attachment B, Tables B.2 and B.3. The ecological PRGs that were based directly on literature values were checked as part of this evaluation. There were not more recent values available. Ecological PRGs are typically only applicable to the top 2 feet of soil. However, burrowing mammals are known to inhabit the floodplain area, and exposures for these receptors may reach down to 5 feet. As a result, a target ecological exposure depth of 5 feet, or to the top of the water table if it is shallower than 5 feet, was considered when developing and applying the SRGs. Although potential risks are likely to be spatially limited, ecological PRGs were also developed for the ABG/FDP area.

Site-specific Soil Screening Levels

Groundwater data collected since the signing of the ROD in 1997 as part of CERCLA long-term monitoring (LTM) and RCRA compliance monitoring were used to evaluate the applicability of the SSLs at Site 1. Because the groundwater data are collected from monitoring wells within the ABG, the data set was not applied to SSL determinations in the OABG. The lines of evidence considered in determining the applicability of the SSL for each COC consisted of evaluating whether the constituent is a COC in groundwater as defined in the ROD; the frequency of detections and exceedances of risk-based screening levels since the ROD, and if exceedances of risk-based screening levels are localized to elevated constituent concentrations in soil. Table 7 presents a summary of the soil-to-groundwater leaching considerations for each of the COCs in the ABG.

Site Remediation Goals and Areas of Concern

SRGs were derived based on the lower of risk-based PRGs (ecological and human health), SSL (as applicable), or facility-wide background concentration (as applicable). As an initial step, SRGs were eliminated if the maximum detected soil concentration for the individual COCs was less than the PRGs and SSL. Table 7 and Table 8 summarize the SRGs for industrial and residential land use in the ABG and OABG, respectively.

AOCs in the ABG were identified for industrial and residential scenarios. Areas requiring remediation in the OABG were identified for an industrial scenario only because it is unlikely with the presence of debris that the residential scenario will be considered in the FS. Ecological considerations were incorporated into all of the scenarios. The ABG evaluation included the FDPs, and the OABG evaluation considered the entire area as a whole that is, no subareas were used.

The lateral extent of the AOCs was estimated using ABG- and OABG-wide 95 percent UCL calculations. Three scenarios were evaluated: ABG industrial, ABG residential, and OABG industrial. In addition, “baseline” iterations of each scenario were conducted, whereby the SRGs were directly compared on a point-to-point basis. This provided a comparison of utilizing a 95 percent UCL approach with a point-to-point approach to determine lateral extent of the AOCs. The estimation of the vertical extent of AOCs will be evaluated in the forthcoming Revised Site 1 Soils FS and refined during the post-FS phase pre-design data collection.

The UCL evaluations were conducted as follows:

1. The data set used for both the ABG and OABG was generated from all Site 1 soil data used for the risk assessment and SRG development.
2. The location and depth of each soil sample was identified. Sample locations are shown on Figures 2 and 3. The evaluation was conducted separately for the ABG and OABG and each evaluation used a combined surface soil and subsurface soil data set.
3. For each of the three scenarios evaluated, the selected SRG was used for each COC (Tables 7 and 8). However, SRGs based on the ecological PRG were flagged because sample depth had to be factored into the evaluation for these COCs because only soil depths of 0 to 5 feet bgs are applicable to ecological exposures at Site 1.
4. The maximum value between parent and field duplicate samples was used in the evaluation.
5. ProUCL (version 4.1) was used to calculate the UCL statistics, which were at the upper 95 percent level. Detects and non-detects were identified when the data were input into ProUCL (detects are shaded gray in the COC concentration columns of Tables 9 though 14). The recommended UCL value from the ProUCL program was used (using all program defaults and letting the program choose the best distribution) for all decision making in the evaluation.
6. The 95 percent UCL was then calculated for each COC using all relevant data for each scenario and compared with their respective SRGs (see row 149 in Table 10).
7. Once the initial 95 percent UCL was determined prior to the removal of any samples, samples to be removed from the data set (to simulate a soil excavation and removal scenario) were identified as follows:
   - For each COC, the ratio of the maximum concentration to the SRG was calculated. The sample with the COC that yielded the highest ratio (for all COCs) was identified for removal at each step.
   - All samples at depths above the selected sample (if the sample was subsurface) were also removed at that step; samples at depths below the sample were not removed at that step (but could be removed in subsequent steps because they remained in the data set). If the identified sample was subsurface and at a depth exceeding 5 feet bgs, the sample was not removed if the SRG was ecologically based.
   - When the sample or samples were removed from the data set, based on the sample concentration-to-SRG ratio, they were not replaced with another value. The UCL was then recalculated for each COC and compared with the respective SRGs. If any of the UCLs exceeded their SRGs, the process was repeated by recalculating the ratio of the maximum concentration (using the remaining samples) to the SRG for each COC and identifying the next sample to be removed. The process was repeated until all of the UCLs (for all COCs) were less than their respective SRGs.

5\. A list of the samples removed was generated for each scenario, in the order they were removed, along with the ratio (to the SRGs) values for each of the COCs at each step. This allowed the incremental improvement to be quantitatively measured for each individual COC, and for all COCs combined.

6\. Once the UCL was less than the SRG for all COCs, the maximum SRG ratio in the remaining samples was determined. This was done to provide the risk managers with information on residual COC concentrations following the completion of the UCL process. Ratio values exceeding 5 were flagged. Further, the maximum surface soil sample concentration in the remaining samples was compared with the ecological PRG to determine the residual COC concentrations to which ecological receptors might be exposed to following completion of the UCL process (because a combined surface soil and subsurface soil data set was used). Ratio values that exceeded 5 were flagged.

The results of the evaluation are summarized as follows:

- ABG industrial scenario
  - For the baseline scenario (that is, SRGs used in a point-to-point comparison), 28 sample locations (out of 85) were identified as exceeding SRGs; 10 based on SRG ratios exceeding 5, and 18 based on SRG ratios between 1 and 5 (Figure 4; Table 9).
  - Based on the UCL scenario, the removal of samples from eight locations was sufficient for the UCLs to meet SRGs (red sample locations on Figure 5; Table 10). Two additional locations had residual ratios exceeding 5 for trichloroethene, copper, and/or lead (orange sample locations on Figure 5). Copper also had a maximum ratio to the ecological PRG exceeding 5. With the two additional locations removed, all ratios were less than 5.
- ABG residential scenario
  - For the baseline scenario, 37 sample locations (out of 85) were identified as exceeding SRGs; 16 based on SRG ratios exceeding 5, and 21 based on SRG ratios between 1 and 5 (Figure 6; Table 11).
  - Based upon the UCL scenario, the removal of the 16 sample locations with the SRG ratios exceeding 5 was sufficient for the UCLs to meet the SRGs except for dioxins (red sample locations on Figure 7; Table 12). Twelve additional sample locations were removed for dioxin concentrations to fall below its SRG (orange sample locations on Figure 7).
- OABG industrial scenario
  - For the baseline scenario, 65 sample locations (out of 135) were identified as exceeding SRGs; 40 based on SRG ratios exceeding 5, 14 based on SRG ratios between 1 and 5, and 11 with low-magnitude metal exceedances (SRG ratio less than 1.5) (Figure 8; Table 13).
  - Based on the UCL scenario, the removal of samples from 43 locations was sufficient for UCLs to meet SRGs (Figure 9; Table 14). All residual ratios were less than 5, and no COC had a maximum ratio to the ecological PRG (for surface samples) exceeding 5.

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Tables

Table 1
Summary of Risks Identified in the Human Health Risk Assessment
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Receptor	Media	Risk	Constituents of Concern
Current Industrial Worker	Surface Soil - Former Disposal Pits	Acceptable	None
	Surface Soil - Outside Active Burning Grounds	Acceptable	None
	Surface Soil - Active Burning Grounds	Acceptable	None
Current Trespasser/Visitor Adolescents	Surface Soil - Former Disposal Pits	Acceptable	None
	Surface Soil - Outside Active Burning Grounds	Acceptable	None
	Surface Soil - Active Burning Grounds	Acceptable	None
Future Industrial Worker	Soil* - Former Disposal Pits	Acceptable	None
	Soil* - Outside Active Burning Grounds	Acceptable	None
	Soil* - Active Burning Grounds	Acceptable	None
Future Trespasser/Visitor Adolescents	Soil* - Former Disposal Pits	Acceptable	None
	Soil* - Outside Active Burning Grounds	Acceptable	None
	Soil* - Active Burning Grounds	Acceptable	None
Future Resident - Adult	Soil* - Former Disposal Pits	Acceptable	None
	Soil* - Outside Active Burning Grounds	Acceptable	None
Future Resident - Child	Soil* - Former Disposal Pits	Unacceptable (noncarcinogenic)	Iron, TCE, aluminum, arsenic, manganese, thallium, and vanadium
	Soil* - Outside Active Burning Grounds	Unacceptable (noncarcinogenic and lead)	Lead, cadmium, iron, manganese, vanadium, TCE, aluminum, antimony, arsenic, chromium, copper, mercury, and thallium
Future Resident - Child/Adult	Soil* - Former Disposal Pits	Unacceptable (carcinogenic)	Dioxin, TCE, arsenic
	Soil* - Outside Active Burning Grounds	Unacceptable (carcinogenic)	PAHs, dioxin, TCE, PCE, and arsenic
Future Construction Worker	Soil* - Former Disposal Pits	Acceptable	None
	Soil* - Outside Active Burning Grounds	Unacceptable (Lead)	Lead
	Soil* - Active Burning Grounds	Acceptable	None
Current/Future Recreational Person - Adult	Surface Water - North Branch Potomac River Adjacent to Site 1	Acceptable	None
	Sediment - North Branch Potomac River Adjacent to Site 1	Acceptable	None
Current/Future Recreational Person - Adolescents	Surface Water - North Branch Potomac River Adjacent to Site 1	Acceptable	None
	Sediment - North Branch Potomac River Adjacent to Site 1	Acceptable	None

Notes:
* Combined surface and subsurface soil
PAH = polyaromatic hydrocarbon
PCE = tetrachloroethene
TCE = trichloroethene

Table 2
Summary of Ecological Chemicals of Concern for Terrestrial Habitats
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Chemical	Floodplain (OABG)		Upland (ABG/FDP)	
	Surface Soil	Food Web	Surface Soil	Food Web
Metals				
Cadmium	X	X		
Chromium	X			
Copper	X		X	
Lead	X	X	X	
Mercury	X	X	X	
Nickel	X			
Silver	X			
Vanadium	X			
Zinc	X	X		
Semivolatile Organic Compounds				
2-Nitroaniline			X	
PAHs	X			
Explosives				
1,3,5-Trinitrobenzene			X	
HMX	X		X	
Nitroglycerin	X		X	
Perchlorate			X	
RDX	X		X	
Volatile Organic Compounds				
1,2-Dichloroethene	X			
Methyl acetate	X			
Trichloroethene	X			
Dioxin/furans				
Total dioxin/furans (TEQ)		X		

Notes:
ABG = active burning ground
FDP = former disposal site
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
OABG = outside active burning ground
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
TEQ = toxic equivalency quotient

Table 3
Input Parameters to the SSL Equilibrium Equation
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Input Parameter Description	Value	Source
Target leachate concentration (C_w), Maximum allowable concentration in groundwater multiplied by the dilution attenuation factor (DAF)	Chemical specific (mg/L)	The maximum allowable concentration in groundwater is the EPA MCL or if an MCL has not been developed then EPA's RSL (November 2011) was used. The screening level for water is based on residential tap water usage with a target cancer risk of 10^{-6} or a noncancer hazard index developed using risk assessment protocols (target organ basis) for site specific chemicals. HI was adjusted by dividing 1.0 by the number of target organs.
Dilution Attenuation Factor (DAF)	ABG - 46 (unitless) OABG – 236 (unitless)	Calculated per EPA (1996) $DAF = 1 + \frac{Kid}{IL}$
Source length parallel to groundwater flow (L)	ABG – (122 m) 400 ft OABG – (35 m) 115 ft	Distance measured from the Former Disposal Pits to the river
Hydraulic conductivity (K) of the uppermost aquifer	7046 m/yr 63.33 ft/d	*Phase III Aquifer Testing at Site 1 and Site 10,* CH2M HILL, 2002
Aquifer thickness (d_a)	ABG - (6.1 m) 20 ft OABG – (3.35 m) 11ft	*Phase III Aquifer Testing at Site 1 and Site 10,* CH2M HILL, 2002
Horizontal hydraulic gradient of the uppermost aquifer (i)	ABG - 0.0103 m/m OABG – 0.028 m/m	Measured from the pre-pumping potentiometric surface map.
Mixing zone depth (d)	ABG - 20 ft OABG – 11 ft	Calculated per EPA (1996) $d = \left(0.0112L^2\right)^{0.5} + d_a\left(1 - \exp\left[\frac{-LI}{Kid_a}\right]\right)$
Total porosity (n), - volumetric (L_{pore}/L_{soil})	0.46 (unitless)	Calculated per EPA (1996) $n = 1 - \left(\frac{\rho_b}{\rho_s}\right)$
Water-filled porosity (θ_w) - volumetric (L_{water}/L_{soil})	0.3 (unitless)	Default value from EPA (1996)
Air-filled porosity (θ_a) - volumetric (L_{air}/L_{soil})	0.16 (unitless)	Calculated per EPA (1996) $\theta_a = n - \theta_w$
Bulk density (ρ_b)	1.5 kg/L	Default value from EPA (1996)
Particle density (ρ_p)	2.65 kg/L	Default value from EPA (1996)

Table 3
Input Parameters to the SSL Equilibrium Equation
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Input Parameter Description	Value	Source
Infiltration rate (I)	0.0804 m/yr 3.16 in/yr	Estimated from Conner et. al. (1997) for a silt soil type (see expanded text below)
Soil fraction organic carbon in vadose zone (foc-soil, g/g)	ABG - 0.0073 (g/g) OABG – 0.0073 (g/g)	Site specific average
Soil pH (SU)	7.0	Site specific average
Organic carbon partition coefficient (K_{oc})	Chemical specific	Source: EPA's RSLs for Chemical Contaminants at Superfund Sites parameter database (November 2011)
Soil/water partition coefficient (K_d)	Chemical specific (L/kg)	Organic compounds: Calculated per EPA, 1996 as: $K_d = K_{oc} \times foc$ Inorganic analytes: Selected from EPA (1996), Table C-4 Metal Kd Values (L/kg) as a Function of pH.
Henry's Law Constant (H')	Chemical specific (dimensionless)	Source: EPA's RSLs for Chemical Contaminants at Superfund Sites parameter database (November 2011)

Notes:
ABG = active burning ground
EPA = United States Environmental Protection Agency
ft = foot
ft/d = foot per day
g/g = gram per gram
HI = hazard index
in/yr = inch per year
kg/L = kilogram per liter
L/kg = liter per kilogram
m = meter
m/m = meter per meter
m/yr = meter per year
MCL = maximum contaminant level
mg/L = milligram per liter
OABG = outside active burning ground
RSL = regional screening level
SU = standard units

Table 4
Input Parameters to the Mass Limit SSL Equilibrium Equation
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

ABG - Perchlorate Soil Screening Level Calculation			
Parameters	Symbol	Units	
Soil Screening Level	SSL	mg/Kg	**0.85**
Affected Soil Layer Thickness	d_s	ft	10
Target Leachate Concentration	Cw	mg/L	0.69
Groundwater Protection Standard	SL	mg/L	0.015
Dilution and Attenuation Factor	DAF	unitless	46
Infiltration Rate	I	in/yr	3.16
Exposure Duration	ED	years	70
Bulk Soil Density	ρ_b	kg/L	1.5
OABG - Perchlorate SSL Calculation			
Parameters	Symbol	Units	
Soil Screening Level	SSL	mg/Kg	**4.35**
Affected Soil Layer Thickness	d_s	ft	10
Target Leachate Concentration	Cw	mg/L	3.5
Groundwater Protection Standard	SL	mg/L	0.015
Dilution and Attenuation Factor	DAF	unitless	236
Infiltration Rate	I	in/yr	3.16
Exposure Duration	ED	years	70
Bulk Soil Density	ρ_b	kg/L	1.5

Notes:
ABG = active burning ground
ft = foot
in/yr = inch per year
kg/L = kilogram per liter
mg/kg = milligram per kilogram
mg/L = milligram per liter

Table 5

Soil to Groundwater Leachability Evaluation for the Active Burning Grounds

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, WV

Chemical Name	SSL (mg/kg) DAF = 46	CAS No.	Former Disposal Pits – Surface Soil					Former Disposal Pits – Subsurface Soil					Active Burning Grounds – Surface Soil					Active Burning Grounds – Subsurface Soil				
			# of Detects	Total Samples	Min (mg/kg)	Max (mg/kg)	COC?	# of Detects	Total Samples	Min (mg/kg)	Max (mg/kg)	COC?	# of Detects	Total Samples	Min (mg/kg)	Max (mg/kg)	COC?	# of Detects	Total Samples	Min (mg/kg)	Max (mg/kg)	COC?
VOCs																						
Acetone	12	67-64-1	1	5	0.052	0.052	No	0				No	4	29	0.005	0.016	No	0	65			No
Benzene	0.3	71-43-2	0				No	0				No					No					No
Bromodichloromethane	1.6	75-27-4	0				No	0				No					No					No
Bromomethane	0.011	74-83-9	0				No	0				No					No					No
Butanone, 2- (MEK)	5.3	78-93-3	0				No	0				No					No					No
Carbon disulfide	1.4	75-15-0	0				No	0				No	0	29			No	1	65	0.002	0.002	No
Chlorobenzene	8.8	108-90-7	1	5	0.006	0.006	No	2	26	0.002	0.004	No					No					No
Chloroform	1.6	67-66-3	0				No	0				No	1	29	0.001	0.001	No	0	65			No
Chloromethane	1.5	74-87-3	0				No	0				No					No					No
Dichloroethene, 1,1-	0.18	75-35-4	0				No	3	43	0.023	0.19	Yes					No					No
Dichloroethene, cis-1,2-	1.6	156-59-2	0				No	5	32	0.018	0.39	No	0	29			No	2	65	3.0E-03	1.6E-02	No
Dichloroethene, trans-1,2-	2.3	156-60-5	0				No	0				No					No					No
Ethylbenzene	110	100-41-4	1	5	0.005	0.005	No	2	26	0.003	0.32	No					No					No
Methyl acetate	16	79-20-9	2	3	0.018	0.18	No	0				No	3	8	0.0012	0.073	No	1	8	0.082	0.082	No
Methyl-2-pentanone, 4- (MIBK)	1.3	108-10-1	0				No	0				No					No					No
Methylcyclohexane	NA	108-87-2	0				No	0				No					No					No
Methylene chloride	0.086	75-09-2	0				No	3	43	0.021	0.062	No	1	29	0.004	0.004	No	1	65	0.004	0.004	No
Styrene	16	100-42-5	2	5	0.001	0.003	No	0				No					No					No
Tetrachloroethene	0.22	127-18-4	0				No	3	26	0.055	0.74	Yes	1	29	0.42	0.42	Yes	10	65	0.003	5.8	Yes
Toluene	89	108-88-3	1	5	0.004	0.004	No	4	26	0.002	0.66	No					No					No
Trichlorobenzene, 1,2,4-	33	120-82-1	0				No	0				No					No					No
Trichloroethane, 1,1,1-	5.5	71-55-6	0				No	14	43	0.0019	0.67	No	0	29			No	1	65	0.005	0.005	No
Trichloroethene	0.16	79-01-6	4	5	0.057	1.8	Yes	34	43	0.005	160	Yes	8	29	0.0016	1.4	Yes	48	65	0.001	12	Yes
Xylene, total	1400	1330-20-7	1	5	0.015	0.015	No	4	26	0.002	1.7	No	0	29			No	3	65	0.002	0.004	No
SVOCs																						
Acenaphthene	68	83-32-9	0				No	0				No					No					No
Acetophenone	4.0	98-86-2	0				No	0				No	0	35			No	1	8	0.055	0.055	No
Anthracene	720	120-12-7	0				No	0				No					No					No
Benzaldehyde	1.9	100-52-7	0				No	0				No					No					No
Benzo(a)anthracene	1.7	56-55-3	0				No	0				No	7	35	0.024	0.066	No	1	16	0.051	0.051	No
Benzo(a)pyrene	39	50-32-8	0				No	0				No	8	35	0.023	0.054	No	1	16	0.044	0.044	No
Benzo(b)fluoranthene	5.8	205-99-2	2	3	0.045	0.067	No	0				No	1	35	0.068	0.068	No	1	16	0.067	0.067	No
Benzo(k)fluoranthene	57	207-08-9	0				No	0				No					No					No
Biphenyl, 1,1-	0.14	92-52-4	0				No	0				No	1	28	0.02	0.02	No	0	15			No
bis(2-Ethylhexyl)phthalate	240	117-81-7	1	3	0.066	0.066	No	4	16	0.043	0.32	No	14	35	0.041	1.6	Yes	1	16	0.071	2.3	No
Butylbenzylphthalate	34	85-68-7	0				No	0				No					No					No
Caprolactam	13	105-60-2	0				No	0				No	2	8	0.041	0.046	No	0	8			No
Carbazole	NA	86-74-8	0				No	0				No					No					No
Chrysene	180	218-01-9	1	3	0.049	0.049	No	1				No	15	35	0.024	0.11	No	1	16	0.069	0.069	No
Dibenz(a,h)anthracene	1.9	53-70-3	0				No	0				No					No					No
Diethylphthalate	49	84-66-2	0				No	0				No	3	35	0.092	0.27	No	3	16	0.22	0.34	No
Dibutylphthalate	27	84-74-2	0				No	0				No					No					No
Fluoranthene	1200	206-44-0	2	3	0.077	0.093	No	1	16	0.043	0.043	No	2	35	0.042	0.087	No	1	16	0.15	0.15	No
Fluorene	68	86-73-7	0				No	0				No					No					No
Indeno(1,2,3-cd)pyrene	19	193-39-5	0				No	0				No					No					No
Methylnaphthalene, 2-	2.3	91-57-6	0				No	3	16	0.071	0.35	No					No					No
Methylphenol, 3- and 4- (p-cresol)	15	106-44-5	0				No	0				No					No					No
Methylphenol, 4- (m-cresol)	7.9	108-39-4	0				No	0				No					No					No
Naphthalene	0.37	91-20-3	0				No	1	16	0.25	0.25	No	1	35	0.04	0.04	No	0	16			No
Nitrosodiphenylamine, n-	8.9	86-30-6	0				No	0				No	2	35	0.16	3	Yes	0	16			No
Pyrene	160	129-00-0	2	3	0.06	0.067	No	0				No	1	35	0.1	0.1	No	1	16	0.095	0.095	No
Dioxins																						
Hexachlorodibenzo-p-dioxin (total)	0.0026	34465-46-8	3	3	8.30E-06	5.20E-05	No	3	15	2.10E-07	1.40E-03	No					No					No
Octachlorodibenzofuran	NA	39001-02-0	3	3	1.60E-05	5.60E-05	No	5	15	2.10E-06	1.40E-03	No					No					No
Octachlorodibenzo-p-dioxin	NA	3268-87-9	3	3	3.00E-04	9.70E-04	No	15	15	3.40E-05	8.90E-03	No					No					No
Pentachlorodibenzofuran, 1,2,3,7,8-	NA	57117-41-6	2	3	7.50E-06	8.20E-06	No	2	15	2.85E-07	7.10E-04	No					No					No
Pentachlorodibenzofuran, 2,3,4,7,8-	NA	57117-31-4	2	3	7.10E-06	7.90E-06	No	1	15	6.00E-04	6.00E-04	No					No					No
TCDD, 2,3,7,8-	0.0025	1746-01-6	1	3	7.70E-07	7.70E-07	No	1	15	1.60E-05	1.60E-05	No	28	28	2.91E-07	1.62E-04	No	23	23	3.67E-07	4.06E-04	No
TCDF, 2,3,7,8-	NA	51207-31-9	3	3	2.30E-06	7.80E-06	No	4	15	2.07E-07	3.80E-04	No					No					No
Explosives																						
Hexahydro-1,2,5-trinitro-1,3,5-triazine (RDX)	0.024	121-82-4	3	3	0.096	1	Yes	6	15	0.053	5.5	Yes	16	35	0.049	34	Yes	8	16	0.069	5.2	Yes
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	150	2691-41-0	2	3	0.25	3.3	No	4	15	0.35	1.5	No	22	35	0.123	51	No	8	16	0.276	5.2	No
Nitroglycerin	0.072	55-63-0	0				No	0				No	1	28	98	98	Yes	2	16	2	4.5	Yes
Trinitrobenzene, 1,3,5-	26	99-35-4	0				No	0				No	2	21	0.026	30	Yes	0	16			No
Trinitrotoluene, 2,4,6-	2.1	118-96-7	0				No	0				No					No					No

Table 5

Soil to Groundwater Leachability Evaluation for the Active Burning Grounds

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, WV

Chemical Name	SSL (mg/kg) DAF = 46	CAS No.	Former Disposal Pits										Active Burning Grounds									
			Surface Soil					Subsurface Soil					Surface Soil					Subsurface Soil				
Metals																						
Aluminum	1000000	7429-90-5	3	3	3940	7020	No	18	18	4430	9090	No	28	28	4680	19000	No	15	15	6100	50500	No
Antimony	12	7440-36-0	0				No	0				No	20	28	0.25	2.5	No	6	15	1.3	17.2	Yes
Arsenic	13	7440-38-2	3	3	3.2	8	No	18	18	4.3	10.6	No	28	28	3.4	9.5	No	15	15	5.3	7.6	No
Barium	3900	7440-39-3	3	3	53.7	151	No	18	18	67.3	206	No	28	28	77.6	255	No	15	15	81.3	207	No
Beryllium	310	7440-41-7	1	3	0.97	0.97	No	3	18	0.63	1.1	No	20	28	0.54	1.2	No	15	15	0.7	1.3	No
Cadmium	25	7440-43-9	1	3	0.45	0.45	No	0				No	21	28	0.56	10.9	No	6	15	0.091	11.9	No
Chromium (III) (Insoluble Salts)	1000000	16065-83-1	3	3	5.1	12.2	No	18	18	8.1	13.6	No	28	3	8.1	23.8	No	15	15	10.7	19.9	No
Cobalt	2.0	7440-48-4	3	3	4	13.3	Yes	17	18	10.4	16.2	Yes	28	3	3.6	16.5	No	15	15	8.4	16.4	Yes
Copper	2100	7440-50-8	3	3	10.5	24.1	No	18	18	11.1	492	No	28	3	17	1820	Yes	15	15	13.5	136	No
Cyanide	93	57-12-5	3	3	0.26	0.91	No	1	18	0.14	0.14	No	24	3	0.13	0.54	No	8	15	0.12	0.3	No
Iron	6400	7439-89-6	3	3	9950	24900	Yes	18	18	14900	31100	Yes	28	28	8980	33200	Yes	15	15	20700	33500	Yes
Lead	160	7439-92-1	3	3	16.3	42.5	No	18	18	9	16.5	No	28	28	14.1	1730	No	15	15	11.9	1760	Yes
Magnesium	NA	7439-95-4	3	3	930	3960	No	18	18	732	24200	No	8	8	831	18400	Yes	8	15	923	2790	No
Manganese	480	7439-96-5	3	3	228	810	Yes	18	18	409	1020	Yes	28	28	208	1120	No	15	15	500	1170	Yes
Mercury	7.6	7439-97-6	3	3	0.067	0.12	No	8	18	0.062	0.12	No	27	28	0.04	7.2	No	12	15	0.03	2	No
Nickel	610	7440-02-0	3	3	0.3	22.5	No	18	18	11.7	23.2	No	28	28	9.5	33.4	Yes	15	15	16.5	27.1	No
Potassium	NA	7440-09-7	3	3	852	1030	No	15	18	552	1060	No	8	8	720	1040	Yes	8	15	743	1180	No
Selenium	10	7782-49-2	2	3	0.65	1.1	No	1	18	0.63	0.63	No	6	28	0.37	0.55	No	8	15	0.98	9	No
Silver	43	7440-22-4	0				No	1	18	1.200000048	1.200000048	No	10	28	0.23	3	No	3	15	0.29	4.1	No
Thallium	6.8	7440-28-0	0				No	4	18	1.3	1.6	No	20	28	0.29	2.3	No	7	15	1.5	2.1	No
Vanadium	360	7440-62-2	3	3	11.9	8.8	No	18	18	10.6	23.60000038	No	28	28	10.3	36.7	Yes	15	15	13.9	24.8	No
Zinc	3300	7440-66-6	3	3	26.4	95.4	No	18	18	37.9	82.69	No	28	28	62.2	271	No	15	15	58.4	222	No

Notes:
CAS = Chemical Abstract Service
DAF = dilution attenuation factor
mg/kg = miiligram per kilogram
NA = not applicable
SSL = soil screening level
SVOC = semivolatile organic compound
VOC = volatile organic compound

Table 6

Soil to Groundwater Leachability Evaluation for the Outside Active Burning Grounds

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical Name	SSL (mg/kg)	CAS No.	Western OABG										Eastern OABG										Central OABG				
	DAF = 236		Surface Soil					Subsurface Soil					Surface Soil					Subsurface Soil					Subsurface Soil				
			# of Detects	Total Samples	Min (mg/kg)	Max (mg/kg)	COC?	# of Detects	Total Samples	Min (mg/kg)	Max (mg/kg)	COC?	# of Detects	Total Samples	Min (mg/kg)	Max (mg/kg)	COC?	# of Detects	Total Samples	Min (mg/kg)	Max (mg/kg)	COC?	# of Detects	Total Samples	Min (mg/kg)	Max (mg/kg)	COC?
VOCs																											
Acetone	62	67-64-1	1	21	0.0096	0.0096	No	3	57	0.003	0.82	No	2	49	0.012	0.43	No	1	19	0.03	0.03	No	0				No
Benzene	1.5	71-43-2	0				No	1	57	0.005	0.005	No	0				No	0				No	0				No
Bromodichloromethane	8.3	75-27-4	0				No	0				No	1	49	0.24	0.24	No	0				No	0				No
Bromomethane	0.054	74-83-9	0				No	1	57	0.003	0.003	No	0				No	0				No	0				No
Butanone, 2- (MEK)	27	78-93-3	1	21	0.0028	0.0028	No	0				No	2	49	0.002	1.4	No	1	19	0.0019	0.0019	No	0				No
Carbon disulfide	7.2	75-15-0	0				No	4	56	0.002	0.006	No	0				No	0				No	0				No
Chlorobenzene	45	108-90-7	0				No	1	57	0.002	0.002	No	0				No	0				No	0				No
Chloroform	8.5	67-66-3	0				No	0				No	0				No	1	19	0.001	0.001	No	0				No
Chloromethane	7.5	74-87-3	1	21	0.37	0.37	No	2	57	0.57	1.3	No	0				No	0				No	0				No
Dichloroethene, 1,1-	0.9	75-35-4	5	21	0.001	0.0026	No	2	62	0.001	0.004	No	0				No	0				No	0				No
Dichloroethene, cis-1,2-	8.4	156-59-2	1	19	0.011	0.011	No	18	33	0.002	0.35	No	13	35	0.002	6.9	No	4	15	0.0017	0.12	No	0				No
Dichloroethene, trans-1,2-	12	156-60-5	0				No	3	33	0.002	0.016	No	1	35	160	160	Yes	0				No	0				No
Ethylbenzene	580	100-41-4	0				No	0				No	0				No	0				No	0				No
Methyl acetate	84	79-20-9	3	19	0.0029	0.85	No	0				No	1	28	2.8	2.8	No	4	15	0.011	1.6	No	0				No
Methyl-2-pentanone, 4- (MIBK)	6.9	108-10-1	0				No	0				No	2	49	0.0037	0.26	No	1	19	0.43	0.43	No	0				No
Methylcyclohexane	NA	108-87-2	2	19	0.0013	0.0015	No	0				No	0				No	0				No	0				No
Methylene chloride	0.44	75-09-2	1	21	0.0013	0.0013	No	8	62	0.003	0.017	No	4	56	0.002	0.012	No	1	19	0.005	0.005	No	0				No
Styrene	82	100-42-5	0				No	0				No	0				No	0				No	0				No
Tetrachloroethene	1.1	127-18-4	0				No	2	57	0.001	0.002	No	19	49	0.002	11	Yes	4	19	0.029	0.73	No	0				No
Toluene	460	108-88-3	1	21	0.0012	0.0012	No	1	57	0.002	0.002	No	1	49	0.21	0.21	No	1	19	0.15	0.15	No	0				No
Trichlorobenzene, 1,2,4-	170	120-82-1	0				No	0				No	0				No	3	21	0.053	81	No	0				No
Trichloroethane, 1,1,1-	28	71-55-6	3	21	0.002	0.0031	No	15	62	0.0019	0.47	No	0				No	2	19	2	0.0022	No	0				No
Trichloroethene	0.81	79-01-6	9	21	0.0044	27	Yes	47	62	0.004	230	Yes	53	56	0.003	730	Yes	14	19	0.0049	82	Yes	5	8	0.006	0.062	No
Xylene, total	7100	1330-20-7	1	21	0.0014	0.0014	No	2	57	0.002	0.006	No	1	49	0.002	0.002	No	0				No	0				No
SVOCs																											
Acenaphthene	350	83-32-9	6	26	0.01	4.1	No	1	29	12	12	No	3	29	0.041	0.066	No	0				No					No
Acetophenone	20	98-86-2	0				No					No	1	28	0.051	0.051	No	1	10	0.055	0.055	No					No
Anthracene	3700	120-12-7	18	26	0.01	8.3	No	4	29	0.049	21	No	3	29	0.11	0.17	No	6	23	0.012	0.099	No	0				No
Benzaldehyde	9.9	100-52-7	3	14	0.26	0.6	No	1	28	0.13	0.13	No	1	28	0.39	0.39	No	1	10	0.3	0.3	No	0				No
Benzo(a)anthracene	8.8	56-55-3	26	26	0.064	8.1	No	11	29	0.06	8	No	5	29	0.097	0.37	No	17	23	0.024	0.22	No	0				No
Benzo(a)pyrene	200	50-32-8	19	26	0.071	12	No	12	29	0.062	55	No	5	29	0.096	0.33	No	15	23	0.024	0.24	No	0				No
Benzo(b)fluoranthene	30	205-99-2	26	26	0.099	21	No	11	29	0.055	65	Yes	6	29	0.051	0.44	No	17	23	0.045	0.29	No	0				No
Benzo(k)fluoranthene	290	207-08-9	19	26	0.042	8.6	No	12	29	0.062	54	No	5	29	0.095	0.39	No	15	23	0.011	0.3	No	0				No
Biphenyl, 1,1-	0.74	92-52-4	3	15	0.043	0.088	No	3	28	0.046	0.89	Yes	3	28	0.049	0.069	No	2	10	0.038	0.053	No	0				No
bis(2-Ethylhexyl)phthalate	1200	117-81-7	4	20	0.066	0.34	No	4	29	0.09	7	No	5	29	0.054	0.21	No	7	16	0.09	26	No	2	8	0.1	0.28	No
Butylbenzylphthalate	170	85-68-7	0				No	0				No	0				No	1	16	0.06	0.06	No	0				No
Caprolactam	69	105-60-2	0				No	0				No	1	28	0.066	0.066	No	1	10	0.068	0.068	No	0				No
Carbazole	NA	86-74-8	5	17	0.043	0.21	No	3	29	0.059	9.5	No	3	29	0.058	0.099	No	1	16	0.043	0.043	No	0				No
Chrysene	900	218-01-9	26	26	0.098	10	No	12	29	0.082	63	No	8	29	0.08	0.52	No	17	23	0.037	0.35	No	1	8	0.11	0.11	No
Dibenz(a,h)anthracene	9.6	53-70-3	4	20	0.051	0.43	No	1	29	2.1	2.1	No	0				No	0				No	0				No
Diethylphthalate	250	84-66-2	2	20	0.04	0.046	No	0				No	3	29	0.051	3.4	No	7	16	0.058	1.3	No	0				No
Dibutylphthalate	140	84-74-2	1	20	0.054	0.054	No	0				No	2	29	0.17	0.46	No	3	16	0.055	0.15	No	0				No
Fluoranthene	6000	206-44-0	26	26	0.12	12	No	16	29	0.048	97	No	8	29	0.071	0.81	No	19	23	0.05	0.36	No	2	8	0.12	0.17	No
Fluorene	350	86-73-7	8	26	0.01	5.5	No	3	29	0.047	11	No	3	29	0.07	0.082	No	0				No	0				No
Indeno(1,2,3-cd)pyrene	97	193-39-5	26	26	0.046	5.4	No	9	29	0.052	18	No	3	29	0.11	0.14	No	13	23	0.019	0.11	No	0				No
Methylnaphthalene, 2-	12	91-57-6	12	20	0.04	0.17	No	6	29	0.05	1.9	No	3	29	0.096	0.17	No	4	16	0.047	0.077	No	0				No
Methylphenol, 3- and 4- (p-cresol)	79	106-44-5	0				No	0				No	1	3	0.064	0.064	No	1	6	0.11	0.11	No	0				No
Methylphenol, 4- (m-cresol)	41	108-39-4	0				No	0				No	0				No	1	10	2.5	2.5	No	0				No
Naphthalene	1.9	91-20-3	6	20	0.05	0.12	No	5	29	0.046	0.65	No	3	29	0.084	0.1	No	2	16	0.051	0.052	No	0				No
Nitrosodiphenylamine, n-	46	86-30-6	0				No	0				No	0				No	1	16	0.44	0.44	No	0				No
Pyrene	810	129-00-0	26	26	0.11	21	No	15	29	0.095	160	No	9	29	0.048	0.79	No	17	23	0.042	0.46	No	2	8	0.11	0.14	No
Dioxins																											
Hexachlorodibenzo-p-dioxin (total)	1.30E-02	34465-46-8	8	8	2.23E-05	1.80E-03	No	14	14	1.74E-07	1.64E-03	No	9	12	1.09E-07	5.60E-04	No	15	15	9.90E-06	1.30E-03	No	3	3	2.22E-07	2.52E-05	No
Octachlorodibenzofuran	NA	39001-02-0	8	8	2.83E-05	4.30E-04	No	7	14	3.54E-06	3.32E-04	No	8	12	4.68E-06	6.20E-04	No	15	15	1.60E-05	1.70E-03	No	2	3	1.37E-04	1.88E-04	No
Octachlorodibenzo-p-dioxin	NA	3268-87-9	8	8	1.07E-03	3.87E-03	No	13	14	6.95E-05	6.52E-03	No	9	12	6.70E-05	1.00E-03	No	15	15	1.50E-04	3.80E-03	No	3	3	1.15E-04	1.25E-03	No
Pentachlorodibenzofuran, 1,2,3,7,8-	NA	57117-41-6	8	8	2.63E-06	7.60E-05	No	9	14	7.36E-08	5.33E-05	No	8	12	1.38E-07	1.50E-04	No	14	15	1.20E-06	2.50E-04	No	2	3	5.71E-06	3.73E-05	No
Pentachlorodibenzofuran, 2,3,4,7,8-	NA	57117-31-4	7	8	2.69E-06	1.00E-05	No	9	14	1.14E-07	1.03E-04	No	8	12	2.23E-07	1.60E-04	No	15	15	1.56E-06	3.00E-04	No	2	3	4.41E-06	4.23E-05	No
TCDD, 2,3,7,8-	1.30E-02	1746-01-6	7	8	2.69E-06	1.00E-05	No	6	14	4.21E-07	4.80E-06	No	2	12	4.80E-07	8.80E-06	No	12	15	7.17E-07	1.60E-05	No	2	3	7.97E-07	1.08E-06	No
TCDF, 2,3,7,8-	NA	51207-31-9	6	8	1.90E-06	6.07E-06	No	7	14	8.26E-07	5.45E-05	No	10	12	2.34E-07	1.60E-04	No	15	15	3.20E-06	1.90E-04	No	2	3	1.51E-05	2.60E-04	No
Explosives																											
Hexahydro-1,2,5-trinitro-1,3,5-triazine (RDX)	0.12	121-82-4	0				No	0				No	2	19	0.14	1.8	Yes	2	8	0.082	7.3	Yes	0				No
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	750	2691-41-0	0				No	0				No	4	19	0.076	75	No	3	8	0.12	530	No	0				No
Nitroglycerin	0.37	55-63-0	0				No	0				No	1	19	30	30	Yes	1	8	0.5	0.5	Yes	0				No
Trinitrobenzene, 1,3,5-	140	99-35-4	0				No	0				No	0				No	0				No	0				No
Trinitrotoluene, 2,4,6-	11	118-96-7	0				No	0				No	0				No	0				No	0				No

Table 6

Soil to Groundwater Leachability Evaluation for the Outside Active Burning Grounds

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical Name	SSL (mg/kg)	CAS No.	Western OABG										Eastern OABG										Central OABG				
	DAF = 236		Surface Soil					Subsurface Soil					Surface Soil					Subsurface Soil					Subsurface Soil				
Metals																											
Aluminum	1,000,000	7429-90-5	32	32	1970	34700	No	30	30	2800	13000	No	30	30	3370	66300	No	23	23	5410	96900	No	8	8	3340	7920	No
Antimony	64	7440-36-0	9	32	3	25.10000038	No	3	18	0.5	4.9	Yes	8	30	0.95	12.89	No	12	23	0.72	16.4	No	0				No
Arsenic	69	7440-38-2	31	32	4.30	18.4	No	30	30	4	21.5	No	30	30	3.9	31	No	23	23	5.9	24.9	No	8	8	3.4	11.2	No
Barium	20,000	7440-39-3	42	43	41.5	837.8	No	30	30	41.8	328	Yes	31	31	46	1510	No	27	27	94.8	758	No	8	8	47.2	143	No
Beryllium	1600	7440-41-7	27	32	0.930000007	2.1	No	29	30	0.49	1.9	No	26	30	0.6	1.8	No	15	23	0.18	1.9	No	8	8	0.47	1.7	No
Cadmium	130	7440-43-9	11	32	0.77	37.5	No	24	30	0.2	12.6	No	27	30	0.12	143	Yes	15	23	0.7	373	No	8	8	0.17	0.79	No
Chromium (III) (Insoluble Salts)	1000000	16065-83-1	45	45	7	110	No	30	30	8.8	37.1	No	31	31	7.7	282	No	27	27	9.5	319	No	8	8	7.4	14.7	No
Cobalt	10	7440-48-4	29	32	15.8	60	No	30	30	3.7	407	Yes	30	30	5.5	53.9	No	23	23	5.5	55.2	No	8	8	7	26.2	No
Copper	11000	7440-50-8	42	43	25.60000038	2150	Yes	30	30	9.2	999	No	31	31	10	13600	No	26	26	17.4	1080	No	8	8	8.8	46.3	No
Cyanide	480	57-12-5	7	23	0.7	1.9	No	0				No	1	7	0.79	0.79	No	5	19	1	1.5	No	0				No
Iron	33000	7439-89-6	32	32	6820	38600	Yes	30	30	16900	40900	Yes	30	30	16400	122000	Yes	23	23	10500	122000	Yes	8	8	16000	32100	No
Lead	830	7439-92-1	35	35	6.5	4500.5	No	30	30	6.7	210	No	31	31	7.5	2540	Yes	27	27	37.1	12100	Yes	8	8	7.1	42.3	No
Magnesium	NA	7439-95-4	31	32	662	14100	Yes	28	30	383	5520	No	30	30	544	30400	No	21	23	700	8810	No	8	8	452	1000	No
Manganese	2500	7439-96-5	32	32	161	2320	No	30	30	158	1450	Yes	30	30	255	1920	Yes	23	23	147	1960	Yes	8	8	326	836	No
Mercury	39	7439-97-6	29	32	0.14	16.80	No	14	30	0.043	5	No	21	30	0.04	22.7	No	22	23	0.091	56.3	No	1	8	0.35	0.35	No
Nickel	3100	7440-02-0	31	32	8.40	185	Yes	30	30	11.6	203	No	30	30	11.6	347	No	23	23	11.39	240	No	8	8	8.8	41.1	No
Potassium	NA	7440-09-7	27	32	558	1710	No	28	30	284	1080	Yes	30	30	284	1750	Yes	20	23	592	1700	Yes	8	8	299	728	No
Selenium	53	7782-49-2	9	32	0.540000021	1.7	No	14	30	0.36	1.3	No	20	30	0.34	1.2	No	6	21	0.71	3.9	No	6	8	0.36	1.3	No
Silver	220	7440-22-4	27	36	1.7	121	Yes	13	30	0.17	104	No	22	31	0.17	104	No	13	23	0.7	70.3	No	2	8	0.25	0.27	No
Thallium	35	7440-28-0	2	32	2.2	3.1	No	0				No	1	30	0.49	0.49	No	0				No	0				No
Vanadium	1800	7440-62-2	31	32	14.60000038	108	No	30	30	10.4	994	Yes	30	30	9.5	97.5	No	23	23	5.59	332	Yes	8	8	10	19.2	No
Zinc	17000	7440-66-6	32	32	23.60000038	4230	Yes	30	30	43.7	1440	Yes	30	30	41.5	3350	Yes	23	23	63.2	3860	Yes	8	8	31.3	161	No

* Exceed 100%

Notes:

CAS = Chemical Abstract Service

DAF = dilution attenuation factor

mg/kg = miiligram per kilogram

NA = not applicable

SSL = soil screening level

SVOC = semivolatile organic compound

VOC = volatile organic compound

Table 7
Active Burning Ground Site Remediation Goal Selection Process
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

COCs[1]	Maximum Conc. in Soil (mg/kg)	Background[2] (mg/kg)	PRG[7] (mg/kg)			Soil to Groundwater Leaching Considerations			SRG[6] (mg/kg)			
			Residential	Industrial	Ecological	SSL[3] (mg/kg)	Is constituent a concern for threat to groundwater?	Is SRG warranted?	Residential Scenario	Basis	Industrial Scenario	Basis
VOCs												
1,1-Dichloroethene	ND[9]	NA	Not a COC	Not a COC	Not a COC	0.18	Yes, constituent identified as a COC in the groundwater ROD and is actively being remediated.	Yes	0.18	SSL	0.18	SSL
Tetrachloroethene	5.80	NA	Not a COC	Not a COC	Not a COC	0.22	Yes, constituent identified as a COC in the groundwater ROD and is actively being remediated.	Yes	0.22	SSL	0.22	SSL
Trichloroethene	160	NA	2.5	4	Not a COC	0.16	Yes, constituent identified as a COC in the groundwater ROD and is actively being remediated.	Yes	0.16	SSL	0.16	SSL
SVOCs												
2-Nitroaniline	13	NA	Not a COC	Not a COC	Insufficient Data[5]	0.70	No; constituent was not detected in groundwater at Site 1 prior to or after the ROD.	No	Constituent was only detected in 2 of 70 soil samples.			
Dioxins												
2,3,7,8-TCDD TEQ[4]	6.42 x10^{-4}	NA	2.5 x 10^{-5}	1.8 x 10^{-4}	Not a COC	2.5E-03	No; constituent was not detected in groundwater at Site 1 prior to or after the ROD.	Yes	2.5 x 10^{-5}	Residential PRG	1.8 x 10^{-4}	Industrial PRG
Explosives												
1,3,5-Trinitrobenzene	30	NA	Not a COC	Not a COC	Insufficient Data[5]	26	No; constituent was detected in 2 of 190 samples post-Rod. Maximum detection is 1.6 µg/L and is below the RSL of 780 µg/L and adjusted RSL of 78 µg/L.	No	Constituent was only detected in 2 of 69 soil samples.			
HMX	51	NA	Not a COC	Not a COC	10	150	No; constituent was detected in 73 of 192 samples post-Rod. Maximum detection is 17 µg/L and is below the RSL of 780 µg/L and adjusted RSL of 78 µg/L. Clean up will focus on ecological concerns in surface soil.	Yes	10 (SS)	Ecological PRG	10 (SS)	Ecological PRG
Nitroglycerin	98	NA	Not a COC	Not a COC	65	0.072	No; constituent detected in 2 of 190 post-Rod samples. Maximum detection of 7.7 µg/L slightly exceeds the RSL (1.5 µg/L) and adjusted RSL (0.15 µg/L). Most detection limits (ranging from 0.2 to 2,000 µg/L) also exceed RSL. Maximum detect in GW35 in 4/14/2010, and following samples from that well not detected – with detection limit of 0.28 µg/L. Other detection in GW04 in 4/14/2010 (0.49 µg/L) below RSL, and not detected in following sample with detection limit of 0.25 µg/L. Clean up will focus on ecological concerns in surface soil.	Yes	65 (SS)	Ecological PRG	65 (SS)	Ecological PRG
Perchlorate	31.3	NA	53	671	1.0	0.85	Yes; Constituent detected in 117 of 192 post-Rod samples; many exceedances of the RSL and MCL.	Yes	0.85	SSL	0.85	SSL
RDX	34	NA	Not a COC	Not a COC	10	0.024	Yes; RDX detected in 76 of 192 post-Rod samples. RSL is 0.61 µg/L. More recent data collected as part of RCRA LTM (2009 through Jan 2011) indicates concentrations of RDX below 8 µg/L. Primary risk associated with EW16, otherwise, risk for all other wells below 10-4, some within 10-4 to 10-5, others lower. Max detect is 330 µg/L in EW16 in 2005 which is the only well with concentrations >10-4 risk level (i.e. >61 µg/L). EW12, EW14, GW34, GW35, GW37 (once) greater than 10-5 risk level (>6.1), but not greater than 61. GW5 >6.1, but last sample between 0.61 and 6.1. GW2 >6.1 in 1/2005, but after than all below 6.1 or nd. GW39 >6.1 4/2007, but later samples below 6.1.	Yes[8]	10 (SS)	Ecological PRG	10 (SS)	Ecological PRG
Metals												
Antimony	17.2	1.2 (SS/SB)	Not a COC	Not a COC	Not a COC	12	No; constituent detected in 20 of 243 post-Rod samples. Maximum detect of 11.2 µg/L (GW37 in 8/9/2006) exceeds MCL (6 µg/L) and RSL (6 µg/L) and adjusted RSL (0.6 µg/L), but not detected in sample from same well in later samples from that well. No other detects exceed MCL.	No	Antimony is not a COC based on human and ecological receptor exposure risk and the potential for concentrations in soil leaching to groundwater at levels resulting in unacceptable risk based on the SSL evaluation is not a concern.			
Arsenic	10.6	10.9 (SS/SB)	3.9	16	Not a COC	13	Yes, constituent detected in 81 of 243 post-Rod groundwater samples. Concentrations fluctuate above and below the MCL.	No	Although constituent concentrations in groundwater fluctuate above the MCL, the maximum concentration in soil is below background.			
Cobalt	16.5	20.9 (SS/SB)	Not a COC	Not a COC	Not a COC	2.0	Yes, constituent detected in 72 of 243 post-Rod groundwater samples; maximum concentration is 22 µg/L which is above the RSL and adjusted RSL.	No	Although constituent present in groundwater above the RSL, the maximum concentration in soil is below background.			
Copper	1,820	36.7 (SS/SB)	Not a COC	Not a COC	253	2,100	No; constituent detected in 12 of 23 (instead of 201 of 364 total Site 1 gw samples). Maximum detect of 1,060 µg/L (was 1,210 µg/L in GW3 in 1994) is below MCL of 1,300 µg/L.	Yes	253 (SS)	Ecological PRG	253 (SS)	Ecological PRG

Table 7
Active Burning Ground Site Remediation Goal Selection Process
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

COCs[1]	Maximum Conc. in Soil (mg/kg)	Background[2] (mg/kg)	PRG[7] (mg/kg)			Soil to Groundwater Leaching Considerations			SRG[6] (mg/kg)			
			Residential	Industrial	Ecological	SSL[3] (mg/kg)	Is constituent a concern for threat to groundwater?	Is SRG warranted?	Residential Scenario	Basis	Industrial Scenario	Basis
Iron	33,500	27,900 (SS) 30,900 (SB)	53,259	671,107	Not a COC	6,400	No; constituent is a human nutrient and the maximum site concentration is not signficantly greater than background levels.	No	Maximum soil concentrations are only slightly above background for ABL and iron is considered an essential human nutrient.			
Lead	1,760	44.4 (SS) 22.5 (SB)	Not a COC	Not a COC	785	160	Yes; constituent detected in 48 of 243 post-Rod samples. Maximum of 130 µg/L in EW14 in 2000 exceeds action level of 15 µg/L. EW16, EW18 in 2000, GW4 in 2006, exceed action level.	Yes	160	SSL	160	SSL
Manganese	1,170	1,090 (SS) 852 (SB)	1,087	8,445	Not a COC	480	Yes, groundwater concentrations post-Rod are above RSLs and adjusted RSLs.	Yes	1,090 (SS) 852 (SB)	Background	1,090 (SS) 852 (SB)	Background
Mercury	7.2	0.31 (SS/SB)	Not a COC	Not a COC	1.61	7.6	No; constituent detected in 27 of 242 (instead of 37 of 338 total site 1 gw samples). Maximum detect of 0.31 µg/L below MCL of 2 µg/L.	Yes	1.61 (SS)	Ecological PRG	1.61 (SS)	Ecological PRG
Thallium	2.3 (SS) 1.5 (SB)	2.3 (SS) 2.1 (SB)	0.38	4.8	Not a COC	6.8	No; constituent detected in 23 of 243 post-Rod samples. Maximum detected of 15.5 µg/L in EW 29 exceeds MCL of 2 µg/L. Not detected again in EW29, but the detection limit is above 2 (is about 6). One other detection exceeded MCL. Based on lack of exceedances of MCL;consideration of SSL not warranted.	No	Maximum soil concentration does not exceed background.		Maximum soil concentration is below the industrial PRG.	
Vanadium	36.7	17.8 (SS/SB)	190	2,397	Not a COC	360	No; vanadium detected in 41 of 243 post-Rod groundwater samples; Maximum concentration of 43.1 µg/L is below the RSL but above the adjusted RSL.	No	Maximum soil concentrations are below the PRGs and SSL.			

Notes:
[1] The COC list was generated using the constituents presented in the *Revised Draft Proposed RAOs and Remediation Goals for Site 1 Soil at Allegany Ballistics Laboratory*, dated July 15, 2009, CH2MHILL.
[2] The background values are taken from Table 3-10 in the *Final Background Soil Investigation Technical Memorandum*, dated March 29, 2004 (CH2M HILL).
[3] The SSL values were generated based on site-specific leaching conditions and a DAF of 46
[4] 2,3,7,8-TCDD TEQ - The ecological PRG is based upon 2,3,7,8-TCDD equivalents, mammalian TEFs, and individual dioxin/furan congeners. The human health 2,3,7,8-TCDD TEQ PRG is based on 2,3,7,8-TCDD, the most toxic dioxin/furan congene
[5] There was insufficient data to develop the PRG for this compound
[6] The SRG was determined as the lowest concentration between the PRGs and SSL; and then the higher value between that number and the backgrounc
[7] PRGs for residential and industrial human receptors and ecological receptors were calculated following risk assessment methods documented in the *Final Focused Remedial Investigation for Site 1 Soil, Operable Unit 4, at Allegany Ballistics Laboratory, dated July 2006.*
[8] The RDX SSL is lower in many cases than the detection limit in soil. In addition, RDX is a constituent present in groundwater above the RSLs; however was not identified as a COC in the groundwater Record of Decision. Groundwater data will continue to be evaluated as part of long-term monitoring to ensure concentrations are at acceptable levels; becuase of the uncertainty in detections in soil and continued groundwater monitoring eforts, achievement of the SSL in this instance is not warranted.
[9] This constituent was not detected in the soils data set used for the draft FS but was included because it is a groundwater COC
µg/L = microgram per liter
COC = constituent of concern
DAF = dilution attenuation factor
FDP = former disposal pit
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
LTM = long-term monitoring
MCL = maximum contaminant level
mg/kg = milligram per kilogram
NA = not applicable/not available
Not a COC = constituent is not a COC for the respective risk pathway
PRG = preliminary remediation goal
RCRA = Resource Concervation and Recovery Act
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
ROD = Record of Decision
RSL = Regional Screening Level
SB = subsurface soil
SRG = site remediation goal
SS = surface soil
SSL = soil screening level
SS/SB = combined surface and subsurface soil
SVOC = semivolatile organic compound
TCDD = Tetrachlorodibenzo-p-dioxin
TEF = toxic equivalence factor
TEQ = toxic equivalency quotient
VOC = volatile organic compound

Table 8

Outside Active Burning Ground Site Remediation Goal Selection Process

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, WV

COCs[1]	Maximum Conc. in Soil (mg/kg)	Background[2] (mg/kg)	PRG[8] (mg/kg)			SSL[3] (mg/kg)	SRG[7] (mg/kg)				
			Residential	Industrial	Ecological		Is SRG warranted?	Residential Scenario	Basis	Industrial Scenario	Basis
VOCs											
1,2,4-Trichlorobenzene	0.081	NA	Not a COC	Not a COC	Not a COC	170	No	Maximum soil concentration is below PRGs and SSL.			
1,2-Dichloroethene[6]	27	NA	Not a COC	Not a COC	0.45	8.4	Yes	0.45 (SS) 8.4 (SB)	Ecological PRG SSL	0.45 (SS) 8.4 (SB)	Ecological PRG SSL
Bromodichloromethane	0.24	NA	Not a COC	Not a COC	Not a COC	8.3	No	Maximum soil concentration is below SSL.			
Methyl acetate	2.8	NA	Not a COC	Not a COC	0.30	84	Yes	0.30 (SS)	Ecological PRG	0.30 (SS)	Ecological PRG
Tetrachloroethene	11	NA	37	61	Not a COC	1.1	Yes	1.1	SSL	1.1	SSL
Trichloroethene	730	NA	2.5	4	2.5	0.81	Yes	0.81	SSL	0.81	SSL
SVOCs											
Benzo(a)anthracene	58	NA	1.5	21	Not a COC	8.8	Yes	1.5	Residential PRG	8.8	SSL
Benzo(a)pyrene	55	NA	0.15	2.1	Not a COC	200	Yes	0.15	Residential PRG	2.1	Industrial PRG
Benzo(b)fluoranthene	65	NA	1.5	21	Not a COC	30	Yes	1.5	Residential PRG	21	Industrial PRG
Benzo(k)fluoranthene	54	NA	15	211	Not a COC	290	Yes	15	Residential PRG	Maximum soil concentration is below the industrial PRG and SSL.	
Dibenz(a,h)anthracene	2.1	NA	0.15	2.1	Not a COC	9.6	Yes	0.15	Residential PRG	2.1	Industrial PRG
Indeno(1,2,3-cd)pyrene	18	NA	1.5	21	Not a COC	97	Yes	1.5	Residential PRG	Maximum soil concentration is below the industrial PRG and SSL.	
Naphthalene	0.65	NA	Not a COC	Not a COC	Not a COC	1.9	No	Maximum soil concentration is below SSL.			
Total PAHs (low molecular weight)	240	NA	Not a COC	Not a COC	29	NA	Yes	29 (SS)	Ecological PRG	29 (SS)	Ecological PRG
Total PAHs (high molecular weight)	492	NA	Not a COC	Not a COC	18	NA	Yes	18 (SS)	Ecological PRG	18 (SS)	Ecological PRG
Dioxins											
2,3,7,8-TCDD TEQ[4]	3.48×10^{-4}	NA	2.5×10^{-5}	1.8×10^{-4}	9.6×10^{-5}	0.013	Yes	2.5×10^{-5}	Residential PRG	9.6×10^{-5} (SS) 1.8×10^{-4} (SB)	Ecological PRG Industrial PRG
Explosives											
HMX	530	NA	Not a COC	Not a COC	10	750	Yes	10 (SS)	Ecological PRG	10 (SS)	Ecological PRG
Nitroglycerin	30	NA	Not a COC	Not a COC	65	0.37	Yes	0.37	SSL	0.37	SSL
Perchlorate	0.85	NA	Not a COC	Not a COC	Not a COC	4.35	No	Maximum soil concentration is below the SSL			
RDX	7.3	NA	Not a COC	Not a COC	10	0.12	Yes	0.12	SSL	0.12	SSL
Metals											
Antimony	25.1	1.2 (SS/SB)	26	284	Not a COC	64	No	Maximum soil concentration is below PRGs and SSL.			
Arsenic[10]	31	15.1 (SS) 10.9 (SB)	3.9	16	Not a COC	69	Yes	15.1 (SS) 10.9 (SB)	Background Background	16	Industrial PRG
Cadmium	373	0.55 (SS) 0.34 (SB)	70	792	17.4	130	Yes	17.4 (SS) 70 (SB)	Ecological PRG Residential PRG	17.4 (SS) 130 (SB)	Ecological PRG SSL
Chromium[5]	319	13.9 (SS/SB)	37,199	252,266	42.7	1.0×10^{6}	Yes	42.7 (SS)	Ecological PRG	42.7 (SS)	Ecological PRG
Cobalt[10]	60	52.3 (SS) 20.9 (SB)	Not a COC	Not a COC	Not a COC	10	Yes	52.3 (SS) 20.9 (SB)	Background Background	52.3 (SS) 20.9 (SB)	Background Background
Copper	13,600	36.7 (SS/SB)	1,522	19,174	253	11,000	Yes	253 (SS) 1,522 (SB)	Ecological PRG Residential PRG	253 (SS) 11,000 (SB)	Ecological PRG SSL
Iron[10]	122,000	35,600 (SS) 30,900 (SB)	26,629	335,553	Not a COC	33,000	Yes	35,600 (SS) 30,900 (SB)	Background Background	35,600 (SS) 33,000 (SB)	Background SSL
Lead	12,100	44.4 (SS) 22.5 (SB)	418	1,235	785	830	Yes	418	Residential PRG	785 (SS) 830 (SB)	Ecological PRG SSL
Manganese	2,320	1,090 (SS) 852 (SB)	543	4,222	Not a COC	2,500	No	1,090 (SS) 852 (SB)	Background	Maximum soil concentration is below PRGs and SSL.	
Mercury	56.3	0.31 (SS/SB)	8.4	79	1.61	39	Yes	1.61 (SS) 8.4 (SB)	Ecological PRG Residential PRG	1.61 (SS) 39 (SB)	Ecological PRG SSL
Nickel[9]	347	32.4 (SS) 23 (SB)	Not a COC	Not a COC	78.4	3,100	Yes	78.4 (SS)	Ecological PRG	78.4 (SS)	Ecological PRG

Table 8

Outside Active Burning Ground Site Remediation Goal Selection Process

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, WV

COCs[1]	Maximum Conc. in Soil (mg/kg)	Background[2] (mg/kg)	PRG[8] (mg/kg)			SSL[3] (mg/kg)	SRG[7] (mg/kg)				
			Residential	Industrial	Ecological		Is SRG warranted?	Residential Scenario	Basis	Industrial Scenario	Basis
Silver	121	NA	Not a COC	Not a COC	42.6	220	Yes	42.6 SS)	Ecological PRG	42.6 (SS)	Ecological PRG
Thallium	3.1	2.1 (SS/SB)	0.38	4.8	Not a COC	35	Yes	2.1	Background	Maximum soil concentration is below PRGs and SSL.	
Vanadium	994	17.8 (SS/SB)	190	2,397	173	1,800	Yes	173 (SS) 190 (SB)	Ecological PRG Residential PRG	173 (SS)	Ecological PRG
Zinc	4,230	136 (SS) 68.6 (SB)	Not a COC	Not a COC	1,170	17,000	Yes	1,170 (SS)	Ecological PRG	1,170 (SS)	Ecological PRG

Notes:

1 The COC list was generated using the constituents presented in the *Revised Draft Proposed RAOs and Remediation Goals for Site 1 Soil at Allegany Ballistics Laboratory* , dated July 15, 2009

2 The background values are taken from Table 3-10 in the *Final Background Soil Investigation Technical Memorandum* , dated March 29, 2004, CH2MHILL.

3 The SSL values were based on site-specific leaching conditions based on site specific input parameters resulting in a DAF of 236.

4 2,3,7,8-TCDD TEQ - The ecological PRG is based upon 2,3,7,8-TCDD equivalents, mammalian TEFs, and individual dioxin/furan congeners. The human health 2,3,7,8-TCDD TEQ PRG is based on 2,3,7,8-TCDD, the most toxic dioxin/furan congener.

5 The human health PRG for chromium was based on chromium III toxicity numbers. The ecological PRG for chromium was based on total chromium. There has not been analysis of CrVI at Site 1 because there is no historical indication of a source.

6 Considered total 1,2-dichloroethene (cis-1,2-ichloroethene + trans-1,2-dichloroethene); however, there is no SSL for total 1,2-dichloroethene. The lower SSL between cis-1,2-dichloroethene (8.4 mg/kg) and trans-1,2-dichloroethene (12 mg/kg) was used.

7 The SRG was determined as the lowest concentration between the PRGs and SSL; and then the higher value between that number and the background

8 PRGs for residential and industrial human receptors and ecological receptors were calculated following risk assessment methods documented in the *Final Focused Remedial Investigation for Site 1 Soil, Operable Unit 4, at Allegany Ballistics Laboratory, dated July 2006 (CH2M HILL).*

9 Ecological PRG for nickel is based upon the maximum reference concentration collected from the river floodplain during the remedial investigation.

10 Because arsenic, cobalt, iron, and thallium had SRGs based on background, the maximum values from the reference (i.e., background) samples collected from the river floodplain during the remedial investigation were used as background values (except for thallium, which was not detected in reference samples) rather than the background concentrations from the area outside the floodplain. This slightly increased the surface soil SRG for arsenic, cobalt, and iron in the OABG.

COC = constituent of concern
DAF = dilution attenuation factor
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
mg/kg = milligram per kilogram
NA = not applicable/not available
Not a COC = constituent is not a COC for the respective risk pathway
PRG = preliminary remediation goal
RAO = remedial action objective
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
SB = subsurface soil
SRG = site remediation goal
SS = surface soil
SS/SB = combined surface and subsurface soil
SSL = soil screening level
SVOC = semi-volatile organic compound
TCDD = tetrachlorodibenzo-p-dioxin
TEF = toxic equivalence factor
TEQ = toxic equivalency quotient
VOC = volatile organic compound

Table 9
Active Burning Grounds - Industrial Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATIONS												COC CONCENTRATION-to-SRG RATIOS														
							VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)				VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)						
						INDUSTRIAL SRGs - Surface Soil (SS):	180	220	160	10,000	65,000	850	10,000	1.80E-04	253	160	1,090	1.61															
						INDUSTRIAL SRGs - Subsurface Soil (SB):	180	220	160	N/A	N/A	850	N/A	1.80E-04	N/A	160	852	N/A															
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Mangenese	Mercury	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury	Maximum Ratio[1]	COC	Other COCs with Ratios > 5
ABG	AS01-SB01	AS01-SS01-R01X	02/21/01	0	1	SS	6	6	6	454	454	66	454	7.69E-05	27.5	39.3	954	0.09								0.43	0.11	0.25	0.88	0.06	0.88	--	--
ABG	AS01-SB02	AS01-SS02-R01X	02/21/01	0	1	SS	6	6	28	1,190	476	56	735	9.38E-05	22.5	1,730	419	0.08			0.18	0.12			0.07	0.52	0.09	10.8	0.38	0.05	10.8	Lead	--
ABG	AS01-SB03	AS01-SS03-R01X	02/21/01	0	1	SS	6	6	6	2,400	476	68	476	7.25E-05	22.4	25.2	912	0.05				0.24		0.08		0.40	0.09	0.16	0.84	0.03	0.84	--	--
ABG	AS01-SB04	AS01-SS04-R01X	02/21/01	0	1	SS	6	6	9	454	476	96	454	7.30E-05	19.2	34.3	797	0.05			0.06			0.11		0.41	0.08	0.21	0.73	0.03	0.73	--	--
ABG	AS01-SB05	AS01-SS05-R01X	02/21/01	0	1	SS	6	6	6	2,250	454	880	784	7.71E-05	19.3	55.2	1,010	0.04				0.23		1.04	0.08	0.43	0.08	0.35	0.93	0.02	1.04	Perchlorate	--
ABG	AS01-SB06	AS01-SS06-R01X	02/21/01	0	1	SS	6	6	6	476	454	95	476	7.09E-05	19.3	26.9	928	0.05						0.11		0.39	0.08	0.17	0.85	0.03	0.85	--	--
ABG	AS01-SB07	AS01-SS07-R01X	02/22/01	0	1	SS	6	6	6	417	435	58	417	5.10E-05	20.5	25.9	783	0.05								0.28	0.08	0.16	0.72	0.03	0.72	--	--
ABG	AS01-SB08	AS01-SS08-R01X	02/21/01	0	1	SS	6	6	6	258	454	63	435	4.86E-05	18.1	30	982	0.05				0.03				0.27	0.07	0.19	0.90	0.03	0.90	--	--
ABG	AS01-SB09	AS01-SS09-R01X	02/22/01	0	1	SS	6	6	6	454	476	63	454	4.97E-05	21.6	38	1,120	0.08								0.28	0.09	0.24	1.03	0.05	1.03	Manganese	--
ABG	AS01-SB10	AS01-SS10-R01X	02/22/01	0	1	SS	6	6	6	124	435	61	417	4.87E-05	17.9	29.5	999	0.05				0.01				0.27	0.07	0.18	0.92	0.03	0.92	--	--
ABG	AS01-SB11	AS01-SS11-R01X	02/22/01	0	1	SS	6	6	3	506	435	58	417	3.85E-05	17.6	96.9	730	0.04			0.02	0.05				0.21	0.07	0.61	0.67	0.02	0.67	--	--
ABG	AS01-SB12	AS01-SS12-R01X	02/22/01	0	1	SS	6	6	6	130	435	62	454	4.60E-05	19.7	53.4	1,120	0.05				0.01				0.26	0.08	0.33	1.03	0.03	1.03	Manganese	--
ABG	AS01-SB13	AS01-SS13-R01X	02/22/01	0	1	SS	6	6	6	417	417	64	417	3.31E-05	20.7	25	1,050	0.06								0.18	0.08	0.16	0.96	0.04	0.96	--	--
ABG	AS01-SB14	AS01-SS14-R01X	02/21/01	0	1	SS	6	6	6	454	454	63	454	6.35E-05	29	101	926	0.06								0.35	0.11	0.63	0.85	0.04	0.85	--	--
ABG	AS01-SB14	AS01-SB14-R01X	02/21/01	1	2	SS	6	6	6	340	454	120	454	1.83E-04	16.2	15.9	911	0.04				0.03		0.14		1.02	0.06	0.10	0.84		1.02	Dioxins	--
ABG	AS01-SB15	AS01-SS15-R01X	02/21/01	0	1	SS	6	6	6	454	435	61	454	4.82E-05	27.2	75.8	777	0.06								0.27	0.11	0.47	0.71	0.04	0.71	--	--
ABG	AS01-SB15	AS01-SB15-R01X	02/21/01	1	2	SS	6	6	6	454	454	61	454	2.12E-04	17.1	20.1	1,030	0.04								1.18	0.07	0.13	0.94		1.18	Dioxins	--
ABG	AS01-SB16	AS01-SS16-R01X	02/22/01	0	1	SS	6	6	6	454	476	59	454	3.69E-04	17.4	26.6	712	0.04								2.05	0.07	0.17	0.65	0.02	2.05	Dioxins	--
ABG	AS01-SB16	AS01-SB16-R01X	02/22/01	1	2	SS	6	6	5	454	476	62	454	2.00E-04	17.5	16	1,010	0.03			0.03			0.07		1.11	0.07	0.10	0.93		1.11	Dioxins	--
ABG	AS01-SB17	AS01-SS17-R01X	02/22/01	0	1	SS	6	6	6	417	454	220	417	5.08E-05	17	30.4	813	0.06						0.26		0.28	0.07	0.19	0.75	0.04	0.75	--	--
ABG	AS01-SB17	AS01-SB17-R01X	02/22/01	1	2	SS	6	6	6	454	476	2,500	454	2.36E-04	16.8	16.7	1,070	0.03						2.94		1.31	0.07	0.10	0.98		2.94	Perchlorate	--
ABG	AS01-SB18	AS01-SS18-R01X	02/22/01	0	1	SS	6	6	6	269	417	62	476	5.01E-05	18.7	134	915	0.38				0.03				0.28	0.07	0.84	0.84	0.24	0.84	--	--
ABG	AS01-SB18	AS01-SB18-R01X	02/22/01	1	2	SS	6	6	6	476	454	61	476	1.87E-04	16.9	22.1	1,170	0.04								1.04	0.07	0.14	1.07		1.07	Manganese	--
ABG	AS01-SB19	AS01-SS19-R01X	02/22/01	0	1	SS	6	6	6	123	417	62	435	3.75E-05	22.8	184	674	0.09				0.01				0.21	0.09	1.15	0.62	0.06	1.15	Lead	--
ABG	AS01-SB19	AS01-SB19-R01X	02/22/01	1	2	SS	6	6	6	435	435	60	435	1.58E-04	18.6	25	1,080	0.04								0.88	0.07	0.16	0.99		0.99	--	--
ABG	AS01-SB20	AS01-SS20-R01X	02/22/01	0	1	SS	6	6	6	435	454	63	435	1.11E-04	20.7	58.1	1,090	0.08								0.62	0.08	0.36	1.00	0.05	1.00	Manganese	--
ABG	AS01-SB20	AS01-SB20-R01X	02/22/01	1	2	SS	6	6	6	417	454	59	417	3.82E-05	17.6	16.6	1,100	0.03								0.21	0.07	0.10	1.01		1.01	Manganese	--
ABG	AS01-SB63	AS01-SS63-0-0_5	09/22/04	0	0.5	SS	14	14	1.6	190	2,500	54.7	49	9.32E-07	20.7	64.9	941	0.13			0.01	0.02			0.00	0.01	0.08	0.41	0.86	0.08	0.86	--	--
ABG	AS01-SB63	AS01-SB63-6_5-7	09/22/04	6.5	7	SB	11	11	13	500	2,500	48.5	500	4.94E-07	15.4	13.7	579	0.061			0.08					0.00		0.09	0.68		0.68	--	--
ABG	AS01-SB64	AS01-SS64-0-0_5	09/22/04	0	0.5	SS	12	12	12	51,000	98,000	31,300	16,000	3.02E-06	18	16.2	1,120	0.067				5.10	1.51	36.8	1.60	0.02	0.07	0.10	1.03	0.04	36.8	Perchlorate	HMX
ABG	AS01-SB64	AS01-SB64-7_5-8	09/22/04	7.5	8	SB	530	530	600	1,300	2,500	18,800	1,100	5.42E-07	13.7	12.9	600	0.066			3.75			22.1		0.00		0.08	0.70		22.1	Perchlorate	--
ABG	AS01-SB65	AS01-SS65-0-0_5	09/22/04	0	0.5	SS	11	11	66	2,200	2,500	47	1,700	2.35E-06	19.9	65.7	879	0.077			0.41	0.22			0.17	0.01	0.08	0.41	0.81	0.05	0.81	--	--
ABG	AS01-SB65	AS01-SB65-1_5-2	09/22/04	1.5	2	SS	11	11	140	1,500	2,500	29.7	940	1.31E-06	17	13.7	932	0.075			0.88	0.15		0.03	0.09	0.01	0.07	0.09	0.86	0.05	0.88	--	--
ABG	AS01-SB66	AS01-SS66-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	52.9	170	2.13E-06	17.6	14.1	1,070	0.066				0.13			0.02	0.01	0.07	0.09	0.98		0.98	--	--
ABG	AS01-SB66	AS01-SB66-1_5-2	09/23/04	1.5	2	SS	14	14	14	810	2,500	48.2	96	1.92E-06	16.3	12.8	922	0.06				0.08			0.01	0.01	0.06	0.08	0.85		0.85	--	--
ABG	AS01-SB67	AS01-SS67-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	45.4	460	3.28E-06	1,820	138	208	0.092				0.13			0.05	0.02	7.19	0.86	0.19	0.06	7.19	Copper	--
ABG	AS01-SB67	AS01-SB67-1_5-2	09/23/04	1.5	2	SS	12	12	11	4,600	2,500	438	69	4.50E-05	24.1	269	546	0.44			0.07	0.46		0.52	0.01	0.25	0.10	1.68	0.50	0.27	1.68	Lead	--
ABG	AS01-SB68	AS01-SS68-0-0_5	09/23/04	0	0.5	SS	12	12	12	500	2,500	47.3	500	1.65E-06	17.2	44.4	520	0.06								0.01	0.07	0.28	0.48	0.04	0.48	--	--
ABG	AS01-SB68	AS01-SB68-1_5-2	09/23/04	1.5	2	SS	610	610	940	5,200	2,000	26.6	74	1.20E-06	36.4	914	692	2			5.88	0.52	0.03	0.03	0.01	0.01	0.14	5.71	0.63	1.24	5.88	TCE	Lead
ABG	AS01-SB69	AS01-SS69-0-0_5	09/23/04	0	0.5	SS	680	420	1,400	20,000	2,500	51.8	2,100	6.01E-06	68.1	106	665	0.16		1.91	8.75	2.00		0.06	0.21	0.03	0.27	0.66	0.61	0.10	8.75	TCE	--
ABG	AS01-SB69	AS01-SB69-1-1_5	09/23/04	1	1.5	SS	800	5,800	12,000	570	2,500	91.2	5,200	2.06E-06	20.1	24.6	783	0.45		26.4	75.0	0.06		0.11	0.52	0.01	0.08	0.15	0.72	0.28	75.0	TCE	Tetrachloroethene
ABG	AS01-SB70	AS01-SS70-0-0_5	09/23/04	0	0.5	SS	12	12	38	420	2,500	49.6	210	5.52E-06	18.9	387	543	7.2			0.24	0.04			0.02	0.03	0.07	2.42	0.50	4.47	4.47	Mercury	--
ABG	AS01-SB70	AS01-SB70-2_5-3	09/23/04	2.5	3	SS	660	660	1,800	2,100	4,500	65	730	3.38E-06	136	1,760	687	0.068			11.3	0.21	0.07	0.08	0.07	0.02	0.54	11.0	0.63		11.3	TCE	Lead
ABG	BG-010/010S/053	HCS-BG-53	07/13/92	13	14	SB	6	6	480	NA	NA	NA	NA	NA	NA	NA	NA	NA			3.00										3.00	TCE	--
ABG	BG-010/010S/053	HCS-BG-10	07/13/92	3	4	SS	6	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.03										0.03	--	--
ABG	BG-010/010S/053	HCS-BG-10S	06/20/94	0	1	SS	11	11	2	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-017/018	HCS-BG-18	07/13/92	10	11	SB	6	6	48	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.30										0.30	--	--
ABG	BG-025/025S/048	HCS-BG-25S	06/20/94	0	1	SS	13	13	3	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-033/033S	HCS-BG-33S	06/20/94	0	1	SS	14	14	14	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-034/034S	HCS-BG-34	07/13/92	3	4	SS	6	6	1	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01										0.01	--	--
ABG	BG-034/034S	HCS-BG-34S	06/20/94	0	1	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-037	HCS-BG-37	07/13/92	3	4	SS	6	3	37	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.01	0.23										0.23	--	--
ABG	BG-055/055S	HCS-BG-55S	06/20/94	0	1	SS	11	11	7	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.04										0.04	--	--
ABG	BG-059/050	HCS-BG-50	07/13/92	11	12	SB	6	6	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01										0.01	--	--
ABG	BG-067/068	HCS-BG-68	07/13/92	11	12	SB	6	12	30	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.05	0.19										0.19	--	--
ABG	BG-132/133	HCS-BG-132	06/22/94	3	5	SS	11	11	89	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.56										0.56	--	--
ABG	BG-132/133	HCS-BG-133	11/15/94	2	3	SS	12	12	37	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.23										0.23	--	--
ABG	BG-180	HCS-BG-180	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-181	HCS-BG-181	10/27/98	2	3	SS	11	11	34	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.21										0.21	--	--
ABG	BG-182/183	HCS-BG-182	10/27/98	2	3	SS	11	11	63	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.39										0.39	--	--
ABG	BG-182/183	HCS-BG-183	10/27/98	4	6	SB	12	12	140	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.88										0.88	--	--
ABG	BG-184/185	HCS-BG-184	10/27/98	2	3	SS	12	12	26	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.16										0.16	--	--
ABG	BG-184/185	HCS-BG-185	10/27/98	4	6	SB	11	11	30	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.19										0.19	--	--
ABG	BG-186/187	HCS-BG-186	10/27/98	2	3	SS	11	11	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01										0.01	--	--
ABG	BG-186/187	HCS-BG-187	10/27/98	4	6	SB	11	11	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06										0.06	--	--
ABG	BG-188/189	HCS-BG-188	10/27/98	2	3	SS	12	12	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06										0.06	--	--
ABG	BG-188/189	HCS-BG-189	10/27/98	4	6	SB	12	12	18	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.11										0.11	--	--
ABG	BG-190	HCS-BG-190	10/27/98	2	3	SS	12	12	53	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.33										0.33	--	--
ABG	BG-191	HCS-BG-191	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-192/193	HCS-BG-192	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-192/193	HCS-BG-193	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-194	HCS-BG-194	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-195	HCS-BG-195	10/27/98	2	3	SS	12	12	74	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.46										0.46	--	--
ABG	BG-196/197	HCS-BG-196	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-196/197	HCS-BG-197	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-198	HCS-BG-198	10/27/98	2	3	SS	12	12	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01										0.01	--	--

Table 9
Active Burning Grounds - Industrial Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATIONS												COC CONCENTRATION-to-SRG RATIOS														
							VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)				VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)						
						INDUSTRIAL SRGs - Surface Soil (SS):	180	220	160	10,000	65,000	850	10,000	1.80E-04	253	160	1,090	1.61															
						INDUSTRIAL SRGs - Subsurface Soil (SB):	180	220	160	N/A	N/A	850	N/A	1.80E-04	N/A	160	852	N/A															
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury	Maximum Ratio[1]	COC	Other COCs with Ratios > 5
ABG	BG-199/200	HCS-BG-199	10/27/98	2	3	SS	12	12	29	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.18										0.18	--	--
ABG	BG-199/200	HCS-BG-200	10/27/98	4	6	SB	12	12	55	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.34										0.34	--	--
ABG	BG-201/202	HCS-BG-201	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-201/202	HCS-BG-202	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-203/204	HCS-BG-203	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-203/204	HCS-BG-204	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-207/208	HCS-BG-207	10/27/98	2	3	SS	11	11	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06										0.06	--	--
ABG	BG-207/208	HCS-BG-208	10/27/98	4	6	SB	11	11	9	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06										0.06	--	--
ABG	BG-209/210	HCS-BG-209	10/27/98	2	3	SS	11	32	44	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.15	0.28										0.28	--	--
ABG	BG-209/210	HCS-BG-210	10/27/98	4	6	SB	12	60	120	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.27	0.75										0.75	--	--
ABG	BG-211/212	HCS-BG-211	10/27/98	2	3	SS	11	3	4	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.01	0.03										0.03	--	--
ABG	BG-211/212	HCS-BG-212	10/27/98	4	6	SB	11	6	11	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.03	0.07										0.07	--	--
ABG	BG-213/214	HCS-BG-213	10/27/98	2	3	SS	11	5	46	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.02	0.29										0.29	--	--
ABG	BG-213/214	HCS-BG-214	10/27/98	4	6	SB	12	6	110	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.03	0.69										0.69	--	--
ABG	BG-215/216	HCS-BG-215	10/27/98	2	3	SS	11	11	18	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.11										0.11	--	--
ABG	BG-215/216	HCS-BG-216	10/27/98	4	6	SB	11	11	12	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.08										0.08	--	--
ABG	BG-217/218	HCS-BG-217	10/27/98	2	3	SS	11	11	3	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.02										0.02	--	--
ABG	BG-217/218	HCS-BG-218	10/27/98	4	6	SB	11	7	3	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.03	0.02										0.03	--	--
ABG	BG-219/220	HCS-BG-219	10/27/98	2	3	SS	11	11	23	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.14										0.14	--	--
ABG	BG-219/220	HCS-BG-220	10/27/98	4	6	SB	13	13	37	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.23										0.23	--	--
ABG	BG-221/222	HCS-BG-221	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-221/222	HCS-BG-222	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BP-01	HCS-BP-1	07/13/92	0.5	1	SS	NA	NA	NA	7,600	NA	NA	6,600	NA	NA	NA	NA	NA				0.76			0.66						0.76	--	--
ABG	BP-02	HCS-BP-2	07/13/92	0.5	1	SS	NA	NA	NA	4,600	NA	NA	7,300	NA	NA	NA	NA	NA				0.46			0.73						0.73	--	--
ABG	BP-03	HCS-BP-3	07/13/92	0.5	1	SS	NA	NA	NA	2,200	NA	NA	2,600	NA	NA	NA	NA	NA							0.26						0.26	--	--
ABG	BP-04	HCS-BP-4	07/13/92	0.5	1	SS	NA	NA	NA	2,300	NA	NA	2,100	NA	NA	NA	NA	NA				0.23			0.21						0.23	--	--
ABG	BP-05	HCS-BP-5	07/13/92	0.5	1	SS	NA	NA	NA	3,900	NA	NA	5,100	NA	NA	NA	NA	NA				0.39			0.51						0.51	--	--
ABG	BP-06	HCS-BP-6	07/13/92	0.5	1	SS	NA	NA	NA	14,000	NA	NA	34,000	NA	NA	NA	NA	NA				1.40			3.40						3.40	RDX	--
ABG	BP-07	HCS-BP-7	07/13/92	0.5	1	SS	NA	NA	NA	12,000	NA	NA	2,800	NA	NA	NA	NA	NA				1.20			0.28						1.20	HMX	--
ABG	BP-08	HCS-BP-8	07/13/92	0.5	1	SS	NA	NA	NA	2,200	NA	NA	2,800	NA	NA	NA	NA	NA							0.28						0.28	--	--
FDP	AS01-SB42	AS01-SB42-(1-2)	10/24/01	1	2	SS	12	12	18	570	57,000	60	570	2.49E-07	16.9	16.2	1,020	0.12			0.11					0.00	0.07	0.10	0.94		0.94	--	--
FDP	AS01-SB43	AS01-SB43-(1-2)	10/24/01	1	2	SS	12	12	12	570	57,000	60	570	4.27E-07	11.1	13	647	0.12								0.00	0.04	0.08	0.59		0.59	--	--
FDP	AS01-SB44	AS01-SB44-(1-2)	10/24/01	1	2	SS	12	12	12	560	56,000	60	560	1.77E-07	15.5	15.1	972	0.11								0.00	0.06	0.09	0.89		0.89	--	--
FDP	AS01-SB60	AS01-SS60-0-0.5	09/21/04	0	0.5	SS	910	910	1,800	250	2,500	54.9	130	1.05E-05	24.1	42.5	810	0.12			11.3	0.03			0.01	0.06	0.10	0.27	0.74	0.07	11.3	TCE	--
FDP	AS01-SB60	AS01-SB60-1-3	09/22/04	1	3	SS	12	12	130	500	2,500	54.6	500	4.93E-07	15.8	14.2	853	0.068			0.81					0.00	0.06	0.09	0.78		0.81	--	--
FDP	AS01-SB60	AS01-SB60-3-5	09/22/04	3	5	SS	11	11	170	500	2,500	48.1	58	9.69E-07	14.6	13.8	790	0.06			1.06				0.01	0.01	0.06	0.09	0.72		1.06	TCE	--
FDP	AS01-SB60	AS01-SB60-5-7	09/22/04	5	7	SB	510	510	930	500	2,500	46.4	53	7.74E-07	13.3	13.4	753	0.099			5.81					0.00		0.08	0.88		5.81	TCE	--
FDP	AS01-SB60	AS01-SB60-7-8	09/22/04	7	8	SB	12	12	150	500	2,500	48.9	500	5.26E-07	11.8	12.3	624	0.097			0.94					0.00		0.08	0.73		0.94	--	--
FDP	AS01-SB61	AS01-SS61-0-0.5	09/21/04	0	0.5	SS	18	18	18	500	2,500	106	96	2.29E-06	18.5	25	762	0.11							0.01	0.01	0.07	0.16	0.70	0.07	0.70	--	--
FDP	AS01-SB61	AS01-SB61-1-3	09/22/04	1	3	SS	13	13	13	500	2,500	53.9	500	1.35E-06	16.7	15.3	995	0.095								0.01	0.07	0.10	0.91	0.06	0.91	--	--
FDP	AS01-SB61	AS01-SB61-3-5	09/22/04	3	5	SS	11	11	11	500	2,500	49.5	500	1.09E-06	14.7	15.4	783	0.12								0.01	0.06	0.10	0.72	0.07	0.72	--	--
FDP	AS01-SB61	AS01-SB61-5-7	09/22/04	5	7	SB	12	12	12	500	2,500	46.5	500	8.04E-07	15.4	13.2	701	0.063								0.00		0.08	0.82		0.82	--	--
FDP	AS01-SB61	AS01-SB61-7-8	09/22/04	7	8	SB	12	12	12	500	2,500	47.7	500	1.39E-06	15.8	16.5	833	0.06								0.01		0.10	0.98		0.98	--	--
FDP	AS01-SB62	AS01-SS62-0-0.5	09/21/04	0	0.5	SS	710	710	1,100	3,300	2,500	74	1,000	7.67E-06	10.5	16.3	228	0.067			6.88	0.33		0.09	0.10	0.04	0.04	0.10	0.21	0.04	6.88	TCE	--
FDP	AS01-SB62	AS01-SB62-1-3	09/22/04	1	3	SS	12,000	12,000	25,000	1,500	2,500	288	2,100	6.42E-04	17.3	14.5	918	0.062			156	0.15		0.34	0.21	3.57	0.07	0.09	0.84	0.04	156	TCE	--
FDP	AS01-SB62	AS01-SB62-3-5	09/22/04	3	5	SS	11,000	11,000	12,000	1,200	2,500	269	4,500	1.30E-06	16.3	13.8	532	0.06			75.0	0.12		0.32	0.45	0.01	0.06	0.09	0.49		75.0	TCE	--
FDP	AS01-SB62	AS01-SB62-5-7	09/22/04	5	7	SB	480	55	6,800	750	2,500	757	5,500	4.70E-07	17.3	14.6	686	0.07		0.25	42.5			0.89		0.00		0.09	0.81		42.5	TCE	--
FDP	AS01-SB62	AS01-SB62-7-8	09/22/04	7	8	SB	530	530	6,300	350	2,500	459	3,600	9.09E-07	15.3	15.1	725	0.086			39.4			0.54		0.01		0.09	0.85		39.4	TCE	--
FDP	BG-004/004S/005/039	HCS-BG-5(92)	07/13/92	10	11	SB	4,500	4,500	76,000	NA	NA	NA	NA	NA	NA	NA	NA	NA			475										475	TCE	--
FDP	BG-004/004S/005/039	HCS-BG-4(92)	07/13/92	3	4	SS	760	740	160,000	NA	NA	NA	NA	NA	NA	NA	NA	NA		3.36	1,000										1,000	TCE	--
FDP	BG-004/004S/005/039	HCS-BG-4S	06/20/94	0	1	SS	12	12	93	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.58										0.58	--	--
FDP	BG-004/004S/005/039	HCS-BG-4(94)	06/20/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	17	14.8	761	0.08									0.07	0.09	0.70		0.70	--	--
FDP	BG-006/007	HCS-BG-6(92)	07/13/92	3	4	SS	6	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.03										0.03	--	--
FDP	BG-006/007	HCS-BG-6(94)	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	492	9	409	0.06									1.94	0.06	0.38		1.94	Copper	--
FDP	BG-008/008S/009/038	HCS-BG-38	07/13/92	12.5	13.5	SB	740	330	42,000	NA	NA	NA	NA	NA	NA	NA	NA	NA		1.50	263										263	TCE	--
FDP	BG-008/008S/009/038	HCS-BG-8S	06/20/94	0	1	SS	11	11	57	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.36										0.36	--	--
FDP	BG-008/008S/009/038	HCS-BG-8	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	16.7	13.4	886	0.07									0.07	0.08	0.81		0.81	--	--
FDP	BG-079	HCS-BG-79	07/13/92	11	12	SB	6	6	380	NA	NA	NA	NA	NA	NA	NA	NA	NA			2.38										2.38	TCE	--
FDP	BG-120/121	HCS-BG-120	06/21/94	3	5	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
FDP	BG-126/127	HCS-BG-127	06/22/94	9	11	SB	12	12	230	NA	NA	NA	NA	NA	NA	NA	NA	NA			1.44										1.44	TCE	--
FDP	BG-128/129	HCS-BG-128	06/22/94	9	11	SB	12	12	260	NA	NA	NA	NA	NA	NA	NA	NA	NA			1.63										1.63	TCE	--
FDP	BG-130/131	HCS-BG-131	06/22/94	9	11	SB	12	12	270	NA	NA	NA	NA	NA	NA	NA	NA	NA			1.69										1.69	TCE	--
FDP	BG-205/206	HCS-BG-205	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
FDP	BG-205/206	HCS-BG-206	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--

1 - Red shading indicates maximum ratios >5; orange shading indicates maximum ratios between 1 and 5
Gray shaded concentrations indicate detections; NA - Not Analyzed

Notes:
µg/kg = microgram per kilogram
COC = constituent of concern
ft = foot
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification
mg/kg = milligram per kilogram
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
SRG = site remediation goal
VOC = volatile organic compound

Table 10
Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATIONS												COC CONCENTRATION-to-SRG RATIOS											
							VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)				VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)			
						INDUSTRIAL SRGs - Surface Soil (SS):	180	220	160	10,000	65,000	850	10,000	1.80E-04	253	160	1,090	1.61												
						INDUSTRIAL SRGs - Subsurface Soil (SB):	180	220	160	N/A	N/A	850	N/A	1.80E-04	N/A	160	852	N/A												
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Mangenese	Mercury	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Mangenese	Mercury
ABG	AS01-SB01	AS01-SS01-R01X	02/21/01	0	1	SS	6	6	6	454	454	66	454	7.69E-05	27.5	39.3	954	0.09								0.43	0.11	0.25	0.88	0.06
ABG	AS01-SB02	AS01-SS02-R01X	02/21/01	0	1	SS	6	6	28	1,190	476	56	735	9.38E-05	22.5	1,730	419	0.08			0.18	0.12			0.07	0.52	0.09	10.8	0.38	0.05
ABG	AS01-SB03	AS01-SS03-R01X	02/21/01	0	1	SS	6	6	6	2,400	476	68	476	7.25E-05	22.4	25.2	912	0.05				0.24		0.08		0.40	0.09	0.16	0.84	0.03
ABG	AS01-SB04	AS01-SS04-R01X	02/21/01	0	1	SS	6	6	9	454	476	96	454	7.30E-05	19.2	34.3	797	0.05			0.06			0.11		0.41	0.08	0.21	0.73	0.03
ABG	AS01-SB05	AS01-SS05-R01X	02/21/01	0	1	SS	6	6	6	2,250	454	880	784	7.71E-05	19.3	55.2	1,010	0.04				0.23		1.04	0.08	0.43	0.08	0.35	0.93	0.02
ABG	AS01-SB06	AS01-SS06-R01X	02/21/01	0	1	SS	6	6	6	476	454	95	476	7.09E-05	19.3	26.9	928	0.05						0.11		0.39	0.08	0.17	0.85	0.03
ABG	AS01-SB07	AS01-SS07-R01X	02/22/01	0	1	SS	6	6	6	417	435	58	417	5.10E-05	20.5	25.9	783	0.05								0.28	0.08	0.16	0.72	0.03
ABG	AS01-SB08	AS01-SS08-R01X	02/21/01	0	1	SS	6	6	6	258	454	63	435	4.86E-05	18.1	30	982	0.05				0.03				0.27	0.07	0.19	0.90	0.03
ABG	AS01-SB09	AS01-SS09-R01X	02/22/01	0	1	SS	6	6	6	454	476	63	454	4.97E-05	21.6	38	1,120	0.08								0.28	0.09	0.24	1.03	0.05
ABG	AS01-SB10	AS01-SS10-R01X	02/22/01	0	1	SS	6	6	6	124	435	61	417	4.87E-05	17.9	29.5	999	0.05				0.01				0.27	0.07	0.18	0.92	0.03
ABG	AS01-SB11	AS01-SS11-R01X	02/22/01	0	1	SS	6	6	3	506	435	58	417	3.85E-05	17.6	96.9	730	0.04			0.02	0.05				0.21	0.07	0.61	0.67	0.02
ABG	AS01-SB12	AS01-SS12-R01X	02/22/01	0	1	SS	6	6	6	130	435	62	454	4.60E-05	19.7	53.4	1,120	0.05				0.01				0.26	0.08	0.33	1.03	0.03
ABG	AS01-SB13	AS01-SS13-R01X	02/22/01	0	1	SS	6	6	6	417	417	64	417	3.31E-05	20.7	25	1,050	0.06								0.18	0.08	0.16	0.96	0.04
ABG	AS01-SB14	AS01-SS14-R01X	02/21/01	0	1	SS	6	6	6	454	454	63	454	6.35E-05	29	101	926	0.06								0.35	0.11	0.63	0.85	0.04
ABG	AS01-SB14	AS01-SB14-R01X	02/21/01	1	2	SS	6	6	6	340	454	120	454	1.83E-04	16.2	15.9	911	0.04				0.03		0.14		1.02	0.06	0.10	0.84	
ABG	AS01-SB15	AS01-SS15-R01X	02/21/01	0	1	SS	6	6	6	454	435	61	454	4.82E-05	27.2	75.8	777	0.06								0.27	0.11	0.47	0.71	0.04
ABG	AS01-SB15	AS01-SB15-R01X	02/21/01	1	2	SS	6	6	6	454	454	61	454	2.12E-04	17.1	20.1	1,030	0.04								1.18	0.07	0.13	0.94	
ABG	AS01-SB16	AS01-SS16-R01X	02/22/01	0	1	SS	6	6	6	454	476	59	454	3.69E-04	17.4	26.6	712	0.04								2.05	0.07	0.17	0.65	0.02
ABG	AS01-SB16	AS01-SB16-R01X	02/22/01	1	2	SS	6	6	5	454	476	62	454	2.00E-04	17.5	16	1,010	0.03			0.03			0.07		1.11	0.07	0.10	0.93	
ABG	AS01-SB17	AS01-SS17-R01X	02/22/01	0	1	SS	6	6	6	417	454	220	417	5.08E-05	17	30.4	813	0.06						0.26		0.28	0.07	0.19	0.75	0.04
ABG	AS01-SB17	AS01-SB17-R01X	02/22/01	1	2	SS	6	6	6	454	476	2,500	454	2.36E-04	16.8	16.7	1,070	0.03						2.94		1.31	0.07	0.10	0.98	
ABG	AS01-SB18	AS01-SS18-R01X	02/22/01	0	1	SS	6	6	6	269	417	62	476	5.01E-05	18.7	134	915	0.38				0.03				0.28	0.07	0.84	0.84	0.24
ABG	AS01-SB18	AS01-SB18-R01X	02/22/01	1	2	SS	6	6	6	476	454	61	476	1.87E-04	16.9	22.1	1,170	0.04								1.04	0.07	0.14	1.07	
ABG	AS01-SB19	AS01-SS19-R01X	02/22/01	0	1	SS	6	6	6	123	417	62	435	3.75E-05	22.8	184	674	0.09				0.01				0.21	0.09	1.15	0.62	0.06
ABG	AS01-SB19	AS01-SB19-R01X	02/22/01	1	2	SS	6	6	6	435	435	60	435	1.58E-04	18.6	25	1,080	0.04								0.88	0.07	0.16	0.99	
ABG	AS01-SB20	AS01-SS20-R01X	02/22/01	0	1	SS	6	6	6	435	454	63	435	1.11E-04	20.7	58.1	1,090	0.08								0.62	0.08	0.36	1.00	0.05
ABG	AS01-SB20	AS01-SB20-R01X	02/22/01	1	2	SS	6	6	6	417	454	59	417	3.82E-05	17.6	16.6	1,100	0.03								0.21	0.07	0.10	1.01	
ABG	AS01-SB63	AS01-SS63-0-0_5	09/22/04	0	0.5	SS	14	14	1.6	190	2,500	54.7	49	9.32E-07	20.7	64.9	941	0.13			0.01	0.02			0.00	0.01	0.08	0.41	0.86	0.08
ABG	AS01-SB63	AS01-SB63-6_5-7	09/22/04	6.5	7	SB	11	11	13	500	2,500	48.5	500	4.94E-07	15.4	13.7	579	0.061			0.08					0.00		0.09	0.68	
ABG	AS01-SB64	AS01-SS64-0-0_5	09/22/04	0	0.5	SS	12	12	12	51,000	98,000	31,300	16,000	3.02E-06	18	16.2	1,120	0.067				5.10	1.51	36.8	1.60	0.02	0.07	0.10	1.03	0.04
ABG	AS01-SB64	AS01-SB64-7_5-8	09/22/04	7.5	8	SB	530	530	600	1,300	2,500	18,800	1,100	5.42E-07	13.7	12.9	600	0.066			3.75			22.1		0.00		0.08	0.70	
ABG	AS01-SB65	AS01-SS65-0-0_5	09/22/04	0	0.5	SS	11	11	66	2,200	2,500	47	1,700	2.35E-06	19.9	65.7	879	0.077			0.41	0.22			0.17	0.01	0.08	0.41	0.81	0.05
ABG	AS01-SB65	AS01-SB65-1_5-2	09/22/04	1.5	2	SS	11	11	140	1,500	2,500	29.7	940	1.31E-06	17	13.7	932	0.075			0.88	0.15		0.03	0.09	0.01	0.07	0.09	0.86	0.05
ABG	AS01-SB66	AS01-SS66-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	52.9	170	2.13E-06	17.6	14.1	1,070	0.066				0.13			0.02	0.01	0.07	0.09	0.98	
ABG	AS01-SB66	AS01-SB66-1_5-2	09/23/04	1.5	2	SS	14	14	14	810	2,500	48.2	96	1.92E-06	16.3	12.8	922	0.06				0.08			0.01	0.01	0.06	0.08	0.85	
ABG	AS01-SB67	AS01-SS67-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	45.4	460	3.28E-06	1,820	138	208	0.092				0.13			0.05	0.02	7.19	0.86	0.19	0.06
ABG	AS01-SB67	AS01-SB67-1_5-2	09/23/04	1.5	2	SS	12	12	11	4,600	2,500	438	69	4.50E-05	24.1	269	546	0.44			0.07	0.46		0.52	0.01	0.25	0.10	1.68	0.50	0.27
ABG	AS01-SB68	AS01-SS68-0-0_5	09/23/04	0	0.5	SS	12	12	12	500	2,500	47.3	500	1.65E-06	17.2	44.4	520	0.06								0.01	0.07	0.28	0.48	0.04
ABG	AS01-SB68	AS01-SB68-1_5-2	09/23/04	1.5	2	SS	610	610	940	5,200	2,000	26.6	74	1.20E-06	36.4	914	692	2			5.88	0.52	0.03	0.03	0.01	0.01	0.14	5.71	0.63	1.24
ABG	AS01-SB69	AS01-SS69-0-0_5	09/23/04	0	0.5	SS	680	420	1,400	20,000	2,500	51.8	2,100	6.01E-06	68.1	106	665	0.16		1.91	8.75	2.00		0.06	0.21	0.03	0.27	0.66	0.61	0.10
ABG	AS01-SB69	AS01-SB69-1-1_5	09/23/04	1	1.5	SS	800	5,800	12,000	570	2,500	91.2	5,200	2.06E-06	20.1	24.6	783	0.45		26.4	75.0	0.06		0.11	0.52	0.01	0.08	0.15	0.72	0.28
ABG	AS01-SB70	AS01-SS70-0-0_5	09/23/04	0	0.5	SS	12	12	38	420	2,500	49.6	210	5.52E-06	18.9	387	543	7.2			0.24	0.04			0.02	0.03	0.07	2.42	0.50	4.47
ABG	AS01-SB70	AS01-SB70-2_5-3	09/23/04	2.5	3	SS	660	660	1,800	2,100	4,500	65	730	3.38E-06	136	1,760	687	0.068			11.3	0.21	0.07	0.08	0.07	0.02	0.54	11.0	0.63	
ABG	BG-010/010S/053	HCS-BG-53	07/13/92	13	14	SB	6	6	480	NA	NA	NA	NA	NA	NA	NA	NA	NA			3.00									
ABG	BG-010/010S/053	HCS-BG-10	07/13/92	3	4	SS	6	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.03									
ABG	BG-010/010S/053	HCS-BG-10S	06/20/94	0	1	SS	11	11	2	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-017/018	HCS-BG-18	07/13/92	10	11	SB	6	6	48	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.30									
ABG	BG-025/025S/048	HCS-BG-25S	06/20/94	0	1	SS	13	13	3	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-033/033S	HCS-BG-33S	06/20/94	0	1	SS	14	14	14	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-034/034S	HCS-BG-34	07/13/92	3	4	SS	6	6	1	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01									
ABG	BG-034/034S	HCS-BG-34S	06/20/94	0	1	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-037	HCS-BG-37	07/13/92	3	4	SS	6	3	37	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.01	0.23									
ABG	BG-055/055S	HCS-BG-55S	06/20/94	0	1	SS	11	11	7	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.04									
ABG	BG-059/050	HCS-BG-50	07/13/92	11	12	SB	6	6	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01									
ABG	BG-067/068	HCS-BG-68	07/13/92	11	12	SB	6	12	30	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.05	0.19									
ABG	BG-132/133	HCS-BG-132	06/22/94	3	5	SS	11	11	89	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.56									
ABG	BG-132/133	HCS-BG-133	11/15/94	2	3	SS	12	12	37	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.23									
ABG	BG-180	HCS-BG-180	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-181	HCS-BG-181	10/27/98	2	3	SS	11	11	34	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.21									
ABG	BG-182/183	HCS-BG-182	10/27/98	2	3	SS	11	11	63	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.39									
ABG	BG-182/183	HCS-BG-183	10/27/98	4	6	SB	12	12	140	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.88									
ABG	BG-184/185	HCS-BG-184	10/27/98	2	3	SS	12	12	26	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.16									
ABG	BG-184/185	HCS-BG-185	10/27/98	4	6	SB	11	11	30	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.19									
ABG	BG-186/187	HCS-BG-186	10/27/98	2	3	SS	11	11	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01									
ABG	BG-186/187	HCS-BG-187	10/27/98	4	6	SB	11	11	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06									
ABG	BG-188/189	HCS-BG-188	10/27/98	2	3	SS	12	12	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06									
ABG	BG-188/189	HCS-BG-189	10/27/98	4	6	SB	12	12	18	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.11									
ABG	BG-190	HCS-BG-190	10/27/98	2	3	SS	12	12	53	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.33									
ABG	BG-191	HCS-BG-191	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-192/193	HCS-BG-192	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-192/193	HCS-BG-193	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-194	HCS-BG-194	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-195	HCS-BG-195	10/27/98	2	3	SS	12	12	74	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.46									
ABG	BG-196/197	HCS-BG-196	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												

Table 10
Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury
							COC CONCENTRATIONS												COC CONCENTRATION-to-SRG RATIOS											
							VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)				VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)			
						INDUSTRIAL SRGs - Surface Soil (SS):	180	220	160	10,000	65,000	850	10,000	1.80E-04	253	160	1,090	1.61												
						INDUSTRIAL SRGs - Subsurface Soil (SB):	180	220	160	N/A	N/A	850	N/A	1.80E-04	N/A	160	852	N/A												
ABG	BG-196/197	HCS-BG-197	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-198	HCS-BG-198	10/27/98	2	3	SS	12	12	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01									
ABG	BG-199/200	HCS-BG-199	10/27/98	2	3	SS	12	12	29	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.18									
ABG	BG-199/200	HCS-BG-200	10/27/98	4	6	SB	12	12	55	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.34									
ABG	BG-201/202	HCS-BG-201	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-201/202	HCS-BG-202	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-203/204	HCS-BG-203	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-203/204	HCS-BG-204	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-207/208	HCS-BG-207	10/27/98	2	3	SS	11	11	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06									
ABG	BG-207/208	HCS-BG-208	10/27/98	4	6	SB	11	11	9	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06									
ABG	BG-209/210	HCS-BG-209	10/27/98	2	3	SS	11	32	44	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.15	0.28									
ABG	BG-209/210	HCS-BG-210	10/27/98	4	6	SB	12	60	120	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.27	0.75									
ABG	BG-211/212	HCS-BG-211	10/27/98	2	3	SS	11	3	4	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.01	0.03									
ABG	BG-211/212	HCS-BG-212	10/27/98	4	6	SB	11	6	11	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.03	0.07									
ABG	BG-213/214	HCS-BG-213	10/27/98	2	3	SS	11	5	46	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.02	0.29									
ABG	BG-213/214	HCS-BG-214	10/27/98	4	6	SB	12	6	110	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.03	0.69									
ABG	BG-215/216	HCS-BG-215	10/27/98	2	3	SS	11	11	18	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.11									
ABG	BG-215/216	HCS-BG-216	10/27/98	4	6	SB	11	11	12	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.08									
ABG	BG-217/218	HCS-BG-217	10/27/98	2	3	SS	11	11	3	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.02									
ABG	BG-217/218	HCS-BG-218	10/27/98	4	6	SB	11	7	3	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.03	0.02									
ABG	BG-219/220	HCS-BG-219	10/27/98	2	3	SS	11	11	23	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.14									
ABG	BG-219/220	HCS-BG-220	10/27/98	4	6	SB	13	13	37	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.23									
ABG	BG-221/222	HCS-BG-221	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-221/222	HCS-BG-222	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BP-01	HCS-BP-1	07/13/92	0.5	1	SS	NA	NA	NA	7,600	NA	NA	6,600	NA	NA	NA	NA	NA				0.76			0.66					
ABG	BP-02	HCS-BP-2	07/13/92	0.5	1	SS	NA	NA	NA	4,600	NA	NA	7,300	NA	NA	NA	NA	NA				0.46			0.73					
ABG	BP-03	HCS-BP-3	07/13/92	0.5	1	SS	NA	NA	NA	2,200	NA	NA	2,600	NA	NA	NA	NA	NA							0.26					
ABG	BP-04	HCS-BP-4	07/13/92	0.5	1	SS	NA	NA	NA	2,300	NA	NA	2,100	NA	NA	NA	NA	NA				0.23			0.21					
ABG	BP-05	HCS-BP-5	07/13/92	0.5	1	SS	NA	NA	NA	3,900	NA	NA	5,100	NA	NA	NA	NA	NA				0.39			0.51					
ABG	BP-06	HCS-BP-6	07/13/92	0.5	1	SS	NA	NA	NA	14,000	NA	NA	34,000	NA	NA	NA	NA	NA				**1.40**			**3.40**					
ABG	BP-07	HCS-BP-7	07/13/92	0.5	1	SS	NA	NA	NA	12,000	NA	NA	2,800	NA	NA	NA	NA	NA				**1.20**			0.28					
ABG	BP-08	HCS-BP-8	07/13/92	0.5	1	SS	NA	NA	NA	2,200	NA	NA	2,800	NA	NA	NA	NA	NA							0.28					
FDP	AS01-SB42	AS01-SB42-(1-2)	10/24/01	1	2	SS	12	12	18	570	57,000	60	570	2.49E-07	16.9	16.2	1,020	0.12			0.11					0.00	0.07	0.10	0.94	
FDP	AS01-SB43	AS01-SB43-(1-2)	10/24/01	1	2	SS	12	12	12	570	57,000	60	570	4.27E-07	11.1	13	647	0.12								0.00	0.04	0.08	0.59	
FDP	AS01-SB44	AS01-SB44-(1-2)	10/24/01	1	2	SS	12	12	12	560	56,000	60	560	1.77E-07	15.5	15.1	972	0.11								0.00	0.06	0.09	0.89	
FDP	AS01-SB60	AS01-SS60-0-0_5	09/21/04	0	0.5	SS	910	910	1,800	250	2,500	54.9	130	1.05E-05	24.1	42.5	810	0.12			**11.3**	0.03			0.01	0.06	0.10	0.27	0.74	0.07
FDP	AS01-SB60	AS01-SB60-1-3	09/22/04	1	3	SS	12	12	130	500	2,500	54.6	500	4.93E-07	15.8	14.2	853	0.068			0.81					0.00	0.06	0.09	0.78	
FDP	AS01-SB60	AS01-SB60-3-5	09/22/04	3	5	SS	11	11	170	500	2,500	48.1	58	9.69E-07	14.6	13.8	790	0.06			**1.06**				0.01	0.01	0.06	0.09	0.72	
FDP	AS01-SB60	AS01-SB60-5-7	09/22/04	5	7	SB	510	510	930	500	2,500	46.4	53	7.74E-07	13.3	13.4	753	0.099			**5.81**					0.00		0.08	0.88	
FDP	AS01-SB60	AS01-SB60-7-8	09/22/04	7	8	SB	12	12	150	500	2,500	48.9	500	5.26E-07	11.8	12.3	624	0.097			0.94					0.00		0.08	0.73	
FDP	AS01-SB61	AS01-SS61-0-0_5	09/21/04	0	0.5	SS	18	18	18	500	2,500	106	96	2.29E-06	18.5	25	762	0.11							0.01	0.01	0.07	0.16	0.70	0.07
FDP	AS01-SB61	AS01-SB61-1-3	09/22/04	1	3	SS	13	13	13	500	2,500	53.9	500	1.35E-06	16.7	15.3	995	0.095								0.01	0.07	0.10	0.91	0.06
FDP	AS01-SB61	AS01-SB61-3-5	09/22/04	3	5	SS	11	11	11	500	2,500	49.5	500	1.09E-06	14.7	15.4	783	0.12								0.01	0.06	0.10	0.72	0.07
FDP	AS01-SB61	AS01-SB61-5-7	09/22/04	5	7	SB	12	12	12	500	2,500	46.5	500	8.04E-07	15.4	13.2	701	0.063								0.00		0.08	0.82	
FDP	AS01-SB61	AS01-SB61-7-8	09/22/04	7	8	SB	12	12	12	500	2,500	47.7	500	1.39E-06	15.8	16.5	833	0.06								0.01		0.10	0.98	
FDP	AS01-SB62	AS01-SS62-0-0_5	09/21/04	0	0.5	SS	710	710	1,100	3,300	2,500	74	1,000	7.67E-06	10.5	16.3	228	0.067			**6.88**	0.33		0.09	0.10	0.04	0.04	0.10	0.21	0.04
FDP	AS01-SB62	AS01-SB62-1-3	09/22/04	1	3	SS	12,000	12,000	25,000	1,500	2,500	288	2,100	6.42E-04	17.3	14.5	918	0.062			**156**	0.15		0.34	0.21	**3.57**	0.07	0.09	0.84	0.04
FDP	AS01-SB62	AS01-SB62-3-5	09/22/04	3	5	SS	11,000	11,000	12,000	1,200	2,500	269	4,500	1.30E-06	16.3	13.8	532	0.06			**75.0**	0.12		0.32	0.45	0.01	0.06	0.09	0.49	
FDP	AS01-SB62	AS01-SB62-5-7	09/22/04	5	7	SB	480	55	6,800	750	2,500	757	5,500	4.70E-07	17.3	14.6	686	0.07		0.25	**42.5**			0.89		0.00		0.09	0.81	
FDP	AS01-SB62	AS01-SB62-7-8	09/22/04	7	8	SB	530	530	6,300	350	2,500	459	3,600	9.09E-07	15.3	15.1	725	0.086			**39.4**			0.54		0.01		0.09	0.85	
FDP	BG-004/004S/005/039	HCS-BG-5(92)	07/13/92	10	11	SB	4,500	4,500	76,000	NA	NA	NA	NA	NA	NA	NA	NA	NA			**475**									
FDP	BG-004/004S/005/039	HCS-BG-4(92)	07/13/92	3	4	SS	760	740	160,000	NA	NA	NA	NA	NA	NA	NA	NA	NA		**3.36**	**1,000**									
FDP	BG-004/004S/005/039	HCS-BG-4S	06/20/94	0	1	SS	12	12	93	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.58									
FDP	BG-004/004S/005/039	HCS-BG-4(94)	06/20/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	17	14.8	761	0.08									0.07	0.09	0.70	
FDP	BG-006/007	HCS-BG-6(92)	07/13/92	3	4	SS	6	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.03									
FDP	BG-006/007	HCS-BG-6(94)	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	492	9	409	0.06									**1.94**	0.06	0.38	
FDP	BG-008/008S/009/038	HCS-BG-38	07/13/92	12.5	13.5	SB	740	330	42,000	NA	NA	NA	NA	NA	NA	NA	NA	NA		**1.50**	**263**									
FDP	BG-008/008S/009/038	HCS-BG-8S	06/20/94	0	1	SS	11	11	57	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.36									
FDP	BG-008/008S/009/038	HCS-BG-8	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	16.7	13.4	886	0.07									0.07	0.08	0.81	
FDP	BG-079	HCS-BG-79	07/13/92	11	12	SB	6	6	380	NA	NA	NA	NA	NA	NA	NA	NA	NA			**2.38**									
FDP	BG-120/121	HCS-BG-120	06/21/94	3	5	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
FDP	BG-126/127	HCS-BG-127	06/22/94	9	11	SB	12	12	230	NA	NA	NA	NA	NA	NA	NA	NA	NA			**1.44**									
FDP	BG-128/129	HCS-BG-128	06/22/94	9	11	SB	12	12	260	NA	NA	NA	NA	NA	NA	NA	NA	NA			**1.63**									
FDP	BG-130/131	HCS-BG-131	06/22/94	9	11	SB	12	12	270	NA	NA	NA	NA	NA	NA	NA	NA	NA			**1.69**									
FDP	BG-205/206	HCS-BG-205	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
FDP	BG-205/206	HCS-BG-206	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												

Table 10
Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATIONS												COC CONCENTRATION-to-SRG RATIOS											
							VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)				VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)			
						INDUSTRIAL SRGs - Surface Soil (SS):	180	220	160	10,000	65,000	850	10,000	1.80E-04	253	160	1,090	1.61												
						INDUSTRIAL SRGs - Subsurface Soil (SB):	180	220	160	N/A	N/A	850	N/A	1.80E-04	N/A	160	852	N/A												
Area	**Station ID**	**Sample ID**	**Sample Date**	**Top of Sample (ft)**	**Sample Bottom (ft)**	**Sample Designation**	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Mangenese	Mercury	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury
						UCL Current Conditions	--	361	11,613	5,948	98,000	3,575	2,604	1.16E-04	183	287	864	0.454												
	STEP 1 (SRG Ratio >10)																													
FDP	BG-004/004S/005/039	HCS-BG-4(92)	07/13/92	3	4	SS	760	740	160,000	NA	NA	NA	NA	NA	NA	NA	NA	NA		3.36	1,000									
FDP	BG-004/004S/005/039	HCS-BG-4S	06/20/94	0	1	SS	12	12	93	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.58									
FDP	BG-004/004S/005/039	HCS-BG-5(92)	07/13/92	10	11	SB	4,500	4,500	76,000	NA	NA	NA	NA	NA	NA	NA	NA	NA			475									
FDP	BG-004/004S/005/039	HCS-BG-4(94)	06/20/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	17	14.8	761	0.08									0.07	0.09	0.70	
FDP	BG-008/008S/009/038	HCS-BG-38	07/13/92	12.5	13.5	SB	740	330	42,000	NA	NA	NA	NA	NA	NA	NA	NA	NA		1.50	263									
FDP	BG-008/008S/009/038	HCS-BG-8	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	16.7	13.4	886	0.07									0.07	0.08	0.81	
FDP	BG-008/008S/009/038	HCS-BG-8S	06/20/94	0	1	SS	11	11	57	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.36									
FDP	AS01-SB62	AS01-SB62-1-3	09/22/04	1	3	SS	12,000	12,000	25,000	1,500	2,500	288	2,100	6.42E-04	17.3	14.5	918	0.062			156	0.15		0.34	0.21	3.57	0.07	0.09	0.84	0.04
FDP	AS01-SB62	AS01-SS62-0-0_5	09/21/04	0	0.5	SS	710	710	1,100	3,300	2,500	74	1,000	7.67E-06	10.5	16.3	228	0.067			6.88	0.33		0.09	0.10	0.04	0.04	0.10	0.21	0.04
ABG	AS01-SB69	AS01-SB69-1-1_5	09/23/04	1	1.5	SS	800	5,800	12,000	570	2,500	91.2	5,200	2.06E-06	20.1	24.6	783	0.45		26.4	75.0	0.06		0.11	0.52	0.01	0.08	0.15	0.72	0.28
ABG	AS01-SB69	AS01-SS69-0-0_5	09/23/04	0	0.5	SS	680	420	1,400	20,000	2,500	51.8	2,100	6.01E-06	68.1	106	665	0.16		1.91	8.75	2.00		0.06	0.21	0.03	0.27	0.66	0.61	0.10
FDP	AS01-SB62	AS01-SB62-3-5	09/22/04	3	5	SS	11,000	11,000	12,000	1,200	2,500	269	4,500	1.30E-06	16.3	13.8	532	0.06			75.0	0.12		0.32	0.45	0.01	0.06	0.09	0.49	
FDP	AS01-SB62	AS01-SB62-5-7	09/22/04	5	7	SB	480	55	6,800	750	2,500	757	5,500	4.70E-07	17.3	14.6	686	0.07		0.25	42.5			0.89		0.00		0.09	0.81	
FDP	AS01-SB62	AS01-SB62-7-8	09/22/04	7	8	SB	530	530	6,300	350	2,500	459	3,600	9.09E-07	15.3	15.1	725	0.086			39.4			0.54		0.01		0.09	0.85	
ABG	AS01-SB64	AS01-SS64-0-0_5	09/22/04	0	0.5	SS	12	12	12	51,000	98,000	31,300	16,000	3.02E-06	18	16.2	1,120	0.067				5.10	1.51	36.8	1.60	0.02	0.07	0.10	1.03	0.04
ABG	AS01-SB64	AS01-SB64-7_5-8	09/22/04	7.5	8	SB	530	530	600	1,300	2,500	18,800	1,100	5.42E-07	13.7	12.9	600	0.066			3.75			22.1		0.00		0.08	0.70	
ABG	AS01-SB70	AS01-SB70-2_5-3	09/23/04	2.5	3	SS	660	660	1,800	2,100	4,500	65	730	3.38E-06	136	1,760	687	0.068			11.3	0.21	0.07	0.08	0.07	0.02	0.54	11.0	0.63	
ABG	AS01-SB70	AS01-SS70-0-0_5	09/23/04	0	0.5	SS	12	12	38	420	2,500	49.6	210	5.52E-06	18.9	387	543	7.2			0.24	0.04			0.02	0.03	0.07	2.42	0.50	4.47
FDP	AS01-SB60	AS01-SS60-0-0_5	09/21/04	0	0.5	SS	910	910	1,800	250	2,500	54.9	130	1.05E-05	24.1	42.5	810	0.12			11.3	0.03			0.01	0.06	0.10	0.27	0.74	0.07
ABG	AS01-SB02	AS01-SS02-R01X	02/21/01	0	1	SS	6	6	28	1,190	476	56	735	9.38E-05	22.5	1,730	419	0.08			0.18	0.12			0.07	0.52	0.09	10.8	0.38	0.05
						UCL Step 1	--	6.83	135	1,991	--	258	2,339	1.27E-04	230	144	907	0.192												
						Maximum - All depths	--	60.0	940	14,000	2,000	2,500	34,000	3.69E-04	1,820	914	1,170	2.00	--	0.27	5.88	1.40	0.03	2.94	3.40	2.05	7.19	5.71	1.07	1.24
						Maximum - SS	--	32.0	940	14,000	2,000	2,500	34,000	3.69E-04	1,820	914	1,170	2.00	--	0.15	5.88	1.40	0.03	2.94	3.40	2.05	7.19	5.71	1.07	1.24
						Ecological PRG	--	--	--	10,000	65,000	1,000	10,000	--	253	785	--	1.61												
						Maximum ratio	--	--	--	1.40	0.03	2.50	3.40	--	7.19	1.16	--	1.24												
	STEP 2 (SRG Ratio >5)																													
ABG	AS01-SB67	AS01-SS67-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	45.4	460	3.28E-06	1,820	138	208	0.092				0.13			0.05	0.02	7.19	0.86	0.19	0.06
ABG	AS01-SB68	AS01-SB68-1_5-2	09/23/04	1.5	2	SS	610	610	940	5,200	2,000	26.6	74	1.20E-06	36.4	914	692	2			5.88	0.52	0.03	0.03	0.01	0.01	0.14	5.71	0.63	1.24
ABG	AS01-SB68	AS01-SS68-0-0_5	09/23/04	0	0.5	SS	12	12	12	500	2,500	47.3	500	1.65E-06	17.2	44.4	520	0.06								0.01	0.07	0.28	0.48	0.04
FDP	AS01-SB60	AS01-SB60-5-7	09/22/04	5	7	SB	510	510	930	500	2,500	46.4	53	7.74E-07	13.3	13.4	753	0.099			5.81					0.00		0.08	0.88	
FDP	AS01-SB60	AS01-SB60-3-5	09/22/04	3	5	SS	11	11	170	500	2,500	48.1	58	9.69E-07	14.6	13.8	790	0.06			1.06				0.01	0.01	0.06	0.09	0.72	
FDP	AS01-SB60	AS01-SB60-1-3	09/22/04	1	3	SS	12	12	130	500	2,500	54.6	500	4.93E-07	15.8	14.2	853	0.068			0.81					0.00	0.06	0.09	0.78	
						UCL Step 2	--	6.99	48.1	2,069	--	239	2,615	1.42E-04	77.7	75.8	935	0.103												
						Maximum - All depths	--	60.0	480	14,000	--	2,500	34,000	3.69E-04	492	269	1,170	0.44	--	0.27	3.00	1.40	--	2.94	3.40	2.05	1.94	1.68	1.07	0.27
						Maximum - SS	--	32.0	140	14,000	--	2,500	34,000	3.69E-04	492	269	1,170	0.44	--	0.15	0.88	1.40	--	2.94	3.40	2.05	1.94	1.68	1.07	0.27
						Ecological PRG	--	--	--	10,000	65,000	1,000	10,000	--	253	785	--	1.61												
						Maximum ratio	--	--	--	1.40	--	2.50	3.40	--	1.94	0.34	--	0.27												

Gray shaded concentrations indicate detections; NA - Not Analyzed

Notes:
µg/kg = microgram per kilogram
COC = constituent of concern
ft = foot
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification
mg/kg = milligram per kilogram
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
SRG = site remediation goal
VOC = volatile organic compound

Table 11
Active Burning Grounds - Residential Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Mangenese	Mercury	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury	Maximum Ratio[1]	COC	Other COCs with Ratios > 5
							COC CONCENTRATIONS												COC CONCENTRATION-to-SRG RATIOS														
							VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)				VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)						
RESIDENTIAL SRGs - Surface Soil (SS):							180	220	160	10,000	65,000	850	10,000	2.50E-05	253	160	1,090	1.61															
RESIDENTIAL SRGs - Subsurface Soil (SB):							180	220	160	N/A	N/A	850	N/A	2.50E-05	N/A	160	852	N/A															
ABG	AS01-SB01	AS01-SS01-R01X	02/21/01	0	1	SS	6	6	6	454	454	66	454	7.69E-05	27.5	39.3	954	0.09								3.08	0.11	0.25	0.88	0.06	3.08	Dioxins	--
ABG	AS01-SB02	AS01-SS02-R01X	02/21/01	0	1	SS	6	6	28	1,190	476	56	735	9.38E-05	22.5	1,730	419	0.08			0.18	0.12			0.07	3.75	0.09	10.8	0.38	0.05	10.8	Lead	--
ABG	AS01-SB03	AS01-SS03-R01X	02/21/01	0	1	SS	6	6	6	2,400	476	68	476	7.25E-05	22.4	25.2	912	0.05				0.24		0.08		2.90	0.09	0.16	0.84	0.03	2.90	Dioxins	--
ABG	AS01-SB04	AS01-SS04-R01X	02/21/01	0	1	SS	6	6	9	454	476	96	454	7.30E-05	19.2	34.3	797	0.05			0.06			0.11		2.92	0.08	0.21	0.73	0.03	2.92	Dioxins	--
ABG	AS01-SB05	AS01-SS05-R01X	02/21/01	0	1	SS	6	6	6	2,250	454	880	784	7.71E-05	19.3	55.2	1,010	0.04				0.23		1.04	0.08	3.08	0.08	0.35	0.93	0.02	3.08	Dioxins	--
ABG	AS01-SB06	AS01-SS06-R01X	02/21/01	0	1	SS	6	6	6	476	454	95	476	7.09E-05	19.3	26.9	928	0.05						0.11		2.84	0.08	0.17	0.85	0.03	2.84	Dioxins	--
ABG	AS01-SB07	AS01-SS07-R01X	02/22/01	0	1	SS	6	6	6	417	435	58	417	5.10E-05	20.5	25.9	783	0.05								2.04	0.08	0.16	0.72	0.03	2.04	Dioxins	--
ABG	AS01-SB08	AS01-SS08-R01X	02/21/01	0	1	SS	6	6	6	258	454	63	435	4.86E-05	18.1	30	982	0.05				0.03				1.94	0.07	0.19	0.90	0.03	1.94	Dioxins	--
ABG	AS01-SB09	AS01-SS09-R01X	02/22/01	0	1	SS	6	6	6	454	476	63	454	4.97E-05	21.6	38	1,120	0.08								1.99	0.09	0.24	1.03	0.05	1.99	Dioxins	--
ABG	AS01-SB10	AS01-SS10-R01X	02/22/01	0	1	SS	6	6	6	124	435	61	417	4.87E-05	17.9	29.5	999	0.05				0.01				1.95	0.07	0.18	0.92	0.03	1.95	Dioxins	--
ABG	AS01-SB11	AS01-SS11-R01X	02/22/01	0	1	SS	6	6	3	506	435	58	417	3.85E-05	17.6	96.9	730	0.04			0.02	0.05				1.54	0.07	0.61	0.67	0.02	1.54	Dioxins	--
ABG	AS01-SB12	AS01-SS12-R01X	02/22/01	0	1	SS	6	6	6	130	435	62	454	4.60E-05	19.7	53.4	1,120	0.05				0.01				1.84	0.08	0.33	1.03	0.03	1.84	Dioxins	--
ABG	AS01-SB13	AS01-SS13-R01X	02/22/01	0	1	SS	6	6	6	417	417	64	417	3.31E-05	20.7	25	1,050	0.06								1.32	0.08	0.16	0.96	0.04	1.32	Dioxins	--
ABG	AS01-SB14	AS01-SS14-R01X	02/21/01	0	1	SS	6	6	6	454	454	63	454	6.35E-05	29	101	926	0.06								2.54	0.11	0.63	0.85	0.04	2.54	Dioxins	--
ABG	AS01-SB14	AS01-SB14-R01X	02/21/01	1	2	SS	6	6	6	340	454	120	454	1.83E-04	16.2	15.9	911	0.04				0.03		0.14		7.33	0.06	0.10	0.84		7.33	Dioxins	--
ABG	AS01-SB15	AS01-SS15-R01X	02/21/01	0	1	SS	6	6	6	454	435	61	454	4.82E-05	27.2	75.8	777	0.06								1.93	0.11	0.47	0.71	0.04	1.93	Dioxins	--
ABG	AS01-SB15	AS01-SB15-R01X	02/21/01	1	2	SS	6	6	6	454	454	61	454	2.12E-04	17.1	20.1	1,030	0.04								8.49	0.07	0.13	0.94		8.49	Dioxins	--
ABG	AS01-SB16	AS01-SS16-R01X	02/22/01	0	1	SS	6	6	6	454	476	59	454	3.69E-04	17.4	26.6	712	0.04								14.8	0.07	0.17	0.65	0.02	14.8	Dioxins	--
ABG	AS01-SB16	AS01-SB16-R01X	02/22/01	1	2	SS	6	6	5	454	476	62	454	2.00E-04	17.5	16	1,010	0.03			0.03			0.07		7.98	0.07	0.10	0.93		7.98	Dioxins	--
ABG	AS01-SB17	AS01-SS17-R01X	02/22/01	0	1	SS	6	6	6	417	454	220	417	5.08E-05	17	30.4	813	0.06						0.26		2.03	0.07	0.19	0.75	0.04	2.03	Dioxins	--
ABG	AS01-SB17	AS01-SB17-R01X	02/22/01	1	2	SS	6	6	6	454	476	2,500	454	2.36E-04	16.8	16.7	1,070	0.03						2.94		9.45	0.07	0.10	0.98		9.45	Dioxins	--
ABG	AS01-SB18	AS01-SS18-R01X	02/22/01	0	1	SS	6	6	6	269	417	62	476	5.01E-05	18.7	134	915	0.38				0.03				2.00	0.07	0.84	0.84	0.24	2.00	Dioxins	--
ABG	AS01-SB18	AS01-SB18-R01X	02/22/01	1	2	SS	6	6	6	476	454	61	476	1.87E-04	16.9	22.1	1,170	0.04								7.50	0.07	0.14	1.07		7.50	Dioxins	--
ABG	AS01-SB19	AS01-SS19-R01X	02/22/01	0	1	SS	6	6	6	123	417	62	435	3.75E-05	22.8	184	674	0.09				0.01				1.50	0.09	1.15	0.62	0.06	1.50	Dioxins	--
ABG	AS01-SB19	AS01-SB19-R01X	02/22/01	1	2	SS	6	6	6	435	435	60	435	1.58E-04	18.6	25	1,080	0.04								6.33	0.07	0.16	0.99		6.33	Dioxins	--
ABG	AS01-SB20	AS01-SS20-R01X	02/22/01	0	1	SS	6	6	6	435	454	63	435	1.11E-04	20.7	58.1	1,090	0.08								4.45	0.08	0.36	1.00	0.05	4.45	Dioxins	--
ABG	AS01-SB20	AS01-SB20-R01X	02/22/01	1	2	SS	6	6	6	417	454	59	417	3.82E-05	17.6	16.6	1,100	0.03								1.53	0.07	0.10	1.01		1.53	Dioxins	--
ABG	AS01-SB63	AS01-SS63-0-0_5	09/22/04	0	0.5	SS	14	14	1.6	190	2,500	54.7	49	9.32E-07	20.7	64.9	941	0.13			0.01	0.02			0.00	0.04	0.08	0.41	0.86	0.08	0.86	--	--
ABG	AS01-SB63	AS01-SB63-6_5-7	09/22/04	6.5	7	SB	11	11	13	500	2,500	48.5	500	4.94E-07	15.4	13.7	579	0.061			0.08					0.02		0.09	0.68		0.68	--	--
ABG	AS01-SB64	AS01-SS64-0-0_5	09/22/04	0	0.5	SS	12	12	12	51,000	98,000	31,300	16,000	3.02E-06	18	16.2	1,120	0.067				5.10	1.51	36.8	1.60	0.12	0.07	0.10	1.03	0.04	36.8	Perchlorate	HMX
ABG	AS01-SB64	AS01-SB64-7_5-8	09/22/04	7.5	8	SB	530	530	600	1,300	2,500	18,800	1,100	5.42E-07	13.7	12.9	600	0.066			3.75			22.1		0.02		0.08	0.70		22.1	Perchlorate	--
ABG	AS01-SB65	AS01-SS65-0-0_5	09/22/04	0	0.5	SS	11	11	66	2,200	2,500	47	1,700	2.35E-06	19.9	65.7	879	0.077			0.41	0.22			0.17	0.09	0.08	0.41	0.81	0.05	0.81	--	--
ABG	AS01-SB65	AS01-SB65-1_5-2	09/22/04	1.5	2	SS	11	11	140	1,500	2,500	29.7	940	1.31E-06	17	13.7	932	0.075			0.88	0.15		0.03	0.09	0.05	0.07	0.09	0.86	0.05	0.88	--	--
ABG	AS01-SB66	AS01-SS66-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	52.9	170	2.13E-06	17.6	14.1	1,070	0.066				0.13			0.02	0.09	0.07	0.09	0.98		0.98	--	--
ABG	AS01-SB66	AS01-SB66-1_5-2	09/23/04	1.5	2	SS	14	14	14	810	2,500	48.2	96	1.92E-06	16.3	12.8	922	0.06				0.08			0.01	0.08	0.06	0.08	0.85		0.85	--	--
ABG	AS01-SB67	AS01-SS67-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	45.4	460	3.28E-06	1,820	138	208	0.092				0.13			0.05	0.13	7.19	0.86	0.19	0.06	7.19	Copper	--
ABG	AS01-SB67	AS01-SB67-1_5-2	09/23/04	1.5	2	SS	12	12	11	4,600	2,500	438	69	4.50E-05	24.1	269	546	0.44			0.07	0.46		0.52	0.01	1.80	0.10	1.68	0.50	0.27	1.80	Dioxins	--
ABG	AS01-SB68	AS01-SS68-0-0_5	09/23/04	0	0.5	SS	12	12	12	500	2,500	47.3	500	1.65E-06	17.2	44.4	520	0.06								0.07	0.07	0.28	0.48	0.04	0.48	--	--
ABG	AS01-SB68	AS01-SB68-1_5-2	09/23/04	1.5	2	SS	610	610	940	5,200	2,000	26.6	74	1.20E-06	36.4	914	692	2			5.88	0.52	0.03	0.03	0.01	0.05	0.14	5.71	0.63	1.24	5.88	TCE	Lead
ABG	AS01-SB69	AS01-SS69-0-0_5	09/23/04	0	0.5	SS	680	420	1,400	20,000	2,500	51.8	2,100	6.01E-06	68.1	106	665	0.16		1.91	8.75	2.00		0.06	0.21	0.24	0.27	0.66	0.61	0.10	8.75	TCE	--
ABG	AS01-SB69	AS01-SB69-1-1_5	09/23/04	1	1.5	SS	800	5,800	12,000	570	2,500	91.2	5,200	2.06E-06	20.1	24.6	783	0.45		26.4	75.0	0.06		0.11	0.52	0.08	0.08	0.15	0.72	0.28	75.0	TCE	Tetrachloroethene
ABG	AS01-SB70	AS01-SS70-0-0_5	09/23/04	0	0.5	SS	12	12	38	420	2,500	49.6	210	5.52E-06	18.9	387	543	7.2			0.24	0.04			0.02	0.22	0.07	2.42	0.50	4.47	4.47	Mercury	--
ABG	AS01-SB70	AS01-SB70-2_5-3	09/23/04	2.5	3	SS	660	660	1,800	2,100	4,500	65	730	3.38E-06	136	1,760	687	0.068			11.3	0.21	0.07	0.08	0.07	0.14	0.54	11.0	0.63		11.3	TCE	Lead
ABG	BG-010/010S/053	HCS-BG-53	07/13/92	13	14	SB	6	6	480	NA	NA	NA	NA	NA	NA	NA	NA	NA			3.00										3.00	TCE	--
ABG	BG-010/010S/053	HCS-BG-10	07/13/92	3	4	SS	6	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.03										0.03	--	--
ABG	BG-010/010S/053	HCS-BG-10S	06/20/94	0	1	SS	11	11	2	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-017/018	HCS-BG-18	07/13/92	10	11	SB	6	6	48	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.30										0.30	--	--
ABG	BG-025/025S/048	HCS-BG-25S	06/20/94	0	1	SS	13	13	3	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-033/033S	HCS-BG-33S	06/20/94	0	1	SS	14	14	14	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-034/034S	HCS-BG-34	07/13/92	3	4	SS	6	6	1	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01										0.01	--	--
ABG	BG-034/034S	HCS-BG-34S	06/20/94	0	1	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-037	HCS-BG-37	07/13/92	3	4	SS	6	3	37	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.01	0.23										0.23	--	--
ABG	BG-055/055S	HCS-BG-55S	06/20/94	0	1	SS	11	11	7	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.04										0.04	--	--
ABG	BG-059/050	HCS-BG-50	07/13/92	11	12	SB	6	6	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01										0.01	--	--
ABG	BG-067/068	HCS-BG-68	07/13/92	11	12	SB	6	12	30	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.05	0.19										0.19	--	--
ABG	BG-132/133	HCS-BG-132	06/22/94	3	5	SS	11	11	89	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.56										0.56	--	--
ABG	BG-132/133	HCS-BG-133	11/15/94	2	3	SS	12	12	37	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.23										0.23	--	--
ABG	BG-180	HCS-BG-180	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-181	HCS-BG-181	10/27/98	2	3	SS	11	11	34	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.21										0.21	--	--
ABG	BG-182/183	HCS-BG-182	10/27/98	2	3	SS	11	11	63	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.39										0.39	--	--
ABG	BG-182/183	HCS-BG-183	10/27/98	4	6	SB	12	12	140	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.88										0.88	--	--
ABG	BG-184/185	HCS-BG-184	10/27/98	2	3	SS	12	12	26	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.16										0.16	--	--
ABG	BG-184/185	HCS-BG-185	10/27/98	4	6	SB	11	11	30	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.19										0.19	--	--
ABG	BG-186/187	HCS-BG-186	10/27/98	2	3	SS	11	11	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01										0.01	--	--
ABG	BG-186/187	HCS-BG-187	10/27/98	4	6	SB	11	11	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06										0.06	--	--
ABG	BG-188/189	HCS-BG-188	10/27/98	2	3	SS	12	12	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06										0.06	--	--
ABG	BG-188/189	HCS-BG-189	10/27/98	4	6	SB	12	12	18	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.11										0.11	--	--
ABG	BG-190	HCS-BG-190	10/27/98	2	3	SS	12	12	53	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.33										0.33	--	--
ABG	BG-191	HCS-BG-191	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-192/193	HCS-BG-192	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-192/193	HCS-BG-193	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-194	HCS-BG-194	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-195	HCS-BG-195	10/27/98	2	3	SS	12	12	74	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.46										0.46	--	--
ABG	BG-196/197	HCS-BG-196	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-196/197	HCS-BG-197	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-198	HCS-BG-198	10/27/98	2	3	SS	12	12	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01										0.01	--	--
ABG	BG-199/200	HCS-BG-199	10/27/98	2	3	SS	12	12	29	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.18										0.18	--	--
ABG	BG-199/200	HCS-BG-200	10/27/98	4	6	SB	12	12	55	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.34										0.34	--	--
ABG	BG-201/202	HCS-BG-201	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-201/202	HCS-BG-202	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-203/204	HCS-BG-203	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-203/204	HCS-BG-204	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA													0.00	--	--
ABG	BG-207/208	HCS-BG-207	10/27/98	2	3	SS	11	11	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06										0.06	--	--

Table 11
Active Burning Grounds - Residential Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

COC CONCENTRATIONS

Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	VOCs (ug/kg) 1,1-Dichloroethene	VOCs (ug/kg) Tetrachloroethene	VOCs (ug/kg) Trichloroethene	Explosives (ug/kg) HMX	Explosives (ug/kg) Nitroglycerin	Explosives (ug/kg) Perchlorate	Explosives (ug/kg) RDX	Dioxins/ Furans (mg/kg) TEQs	Metals (mg/kg) Copper	Metals (mg/kg) Lead	Metals (mg/kg) Mangenese	Metals (mg/kg) Mercury
						RESIDENTIAL SRGs - Surface Soil (SS):	180	220	160	10,000	65,000	850	10,000	2.50E-05	253	160	1,090	1.61
						RESIDENTIAL SRGs - Subsurface Soil (SB):	180	220	160	N/A	N/A	850	N/A	2.50E-05	N/A	160	852	N/A
ABG	BG-207/208	HCS-BG-208	10/27/98	4	6	SB	11	11	9	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-209/210	HCS-BG-209	10/27/98	2	3	SS	11	32	44	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-209/210	HCS-BG-210	10/27/98	4	6	SB	12	60	120	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-211/212	HCS-BG-211	10/27/98	2	3	SS	11	3	4	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-211/212	HCS-BG-212	10/27/98	4	6	SB	11	6	11	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-213/214	HCS-BG-213	10/27/98	2	3	SS	11	5	46	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-213/214	HCS-BG-214	10/27/98	4	6	SB	12	6	110	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-215/216	HCS-BG-215	10/27/98	2	3	SS	11	11	18	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-215/216	HCS-BG-216	10/27/98	4	6	SB	11	11	12	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-217/218	HCS-BG-217	10/27/98	2	3	SS	11	11	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-217/218	HCS-BG-218	10/27/98	4	6	SB	11	7	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-219/220	HCS-BG-219	10/27/98	2	3	SS	11	11	23	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-219/220	HCS-BG-220	10/27/98	4	6	SB	13	13	37	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-221/222	HCS-BG-221	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-221/222	HCS-BG-222	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BP-01	HCS-BP-1	07/13/92	0.5	1	SS	NA	NA	NA	7,600	NA	NA	6,600	NA	NA	NA	NA	NA
ABG	BP-02	HCS-BP-2	07/13/92	0.5	1	SS	NA	NA	NA	4,600	NA	NA	7,300	NA	NA	NA	NA	NA
ABG	BP-03	HCS-BP-3	07/13/92	0.5	1	SS	NA	NA	NA	2,200	NA	NA	2,600	NA	NA	NA	NA	NA
ABG	BP-04	HCS-BP-4	07/13/92	0.5	1	SS	NA	NA	NA	2,300	NA	NA	2,100	NA	NA	NA	NA	NA
ABG	BP-05	HCS-BP-5	07/13/92	0.5	1	SS	NA	NA	NA	3,900	NA	NA	5,100	NA	NA	NA	NA	NA
ABG	BP-06	HCS-BP-6	07/13/92	0.5	1	SS	NA	NA	NA	14,000	NA	NA	34,000	NA	NA	NA	NA	NA
ABG	BP-07	HCS-BP-7	07/13/92	0.5	1	SS	NA	NA	NA	12,000	NA	NA	2,800	NA	NA	NA	NA	NA
ABG	BP-08	HCS-BP-8	07/13/92	0.5	1	SS	NA	NA	NA	2,200	NA	NA	2,800	NA	NA	NA	NA	NA
FDP	AS01-SB42	AS01-SB42-(1-2)	10/24/01	1	2	SS	12	12	18	570	57,000	60	570	2.49E-07	16.9	16.2	1,020	0.12
FDP	AS01-SB43	AS01-SB43-(1-2)	10/24/01	1	2	SS	12	12	12	570	57,000	60	570	4.27E-07	11.1	13	647	0.12
FDP	AS01-SB44	AS01-SB44-(1-2)	10/24/01	1	2	SS	12	12	12	560	56,000	60	560	1.77E-07	15.5	15.1	972	0.11
FDP	AS01-SB60	AS01-SS60-0-0_5	09/21/04	0	0.5	SS	910	910	1,800	250	2,500	54.9	130	1.05E-05	24.1	42.5	810	0.12
FDP	AS01-SB60	AS01-SB60-1-3	09/22/04	1	3	SS	12	12	130	500	2,500	54.6	500	4.93E-07	15.8	14.2	853	0.068
FDP	AS01-SB60	AS01-SB60-3-5	09/22/04	3	5	SS	11	11	170	500	2,500	48.1	58	9.69E-07	14.6	13.8	790	0.06
FDP	AS01-SB60	AS01-SB60-5-7	09/22/04	5	7	SB	510	510	930	500	2,500	46.4	53	7.74E-07	13.3	13.4	753	0.099
FDP	AS01-SB60	AS01-SB60-7-8	09/22/04	7	8	SB	12	12	150	500	2,500	48.9	500	5.26E-07	11.8	12.3	624	0.097
FDP	AS01-SB61	AS01-SS61-0-0_5	09/21/04	0	0.5	SS	18	18	18	500	2,500	106	96	2.29E-06	18.5	25	762	0.11
FDP	AS01-SB61	AS01-SB61-1-3	09/22/04	1	3	SS	13	13	13	500	2,500	53.9	500	1.35E-06	16.7	15.3	995	0.095
FDP	AS01-SB61	AS01-SB61-3-5	09/22/04	3	5	SS	11	11	11	500	2,500	49.5	500	1.09E-06	14.7	15.4	783	0.12
FDP	AS01-SB61	AS01-SB61-5-7	09/22/04	5	7	SB	12	12	12	500	2,500	46.5	500	8.04E-07	15.4	13.2	701	0.063
FDP	AS01-SB61	AS01-SB61-7-8	09/22/04	7	8	SB	12	12	12	500	2,500	47.7	500	1.39E-06	15.8	16.5	833	0.06
FDP	AS01-SB62	AS01-SS62-0-0_5	09/21/04	0	0.5	SS	710	710	1,100	3,300	2,500	74	1,000	7.67E-06	10.5	16.3	228	0.067
FDP	AS01-SB62	AS01-SB62-1-3	09/22/04	1	3	SS	12,000	12,000	25,000	1,500	2,500	288	2,100	6.42E-04	17.3	14.5	918	0.062
FDP	AS01-SB62	AS01-SB62-3-5	09/22/04	3	5	SS	11,000	11,000	12,000	1,200	2,500	269	4,500	1.30E-06	16.3	13.8	532	0.06
FDP	AS01-SB62	AS01-SB62-5-7	09/22/04	5	7	SB	480	55	6,800	750	2,500	757	5,500	4.70E-07	17.3	14.6	686	0.07
FDP	AS01-SB62	AS01-SB62-7-8	09/22/04	7	8	SB	530	530	6,300	350	2,500	459	3,600	9.09E-07	15.3	15.1	725	0.086
FDP	BG-004/004S/005/039	HCS-BG-5(92)	07/13/92	10	11	SB	4,500	4,500	76,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-004/004S/005/039	HCS-BG-4(92)	07/13/92	3	4	SS	760	740	160,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-004/004S/005/039	HCS-BG-4S	06/20/94	0	1	SS	12	12	93	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-004/004S/005/039	HCS-BG-4(94)	06/20/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	17	14.8	761	0.08
FDP	BG-006/007	HCS-BG-6(92)	07/13/92	3	4	SS	6	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-006/007	HCS-BG-6(94)	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	492	9	409	0.06
FDP	BG-008/008S/009/038	HCS-BG-38	07/13/92	12.5	13.5	SB	740	330	42,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-008/008S/009/038	HCS-BG-8S	06/20/94	0	1	SS	11	11	57	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-008/008S/009/038	HCS-BG-8	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	16.7	13.4	886	0.07
FDP	BG-079	HCS-BG-79	07/13/92	11	12	SB	6	6	380	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-120/121	HCS-BG-120	06/21/94	3	5	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-126/127	HCS-BG-127	06/22/94	9	11	SB	12	12	230	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-128/129	HCS-BG-128	06/22/94	9	11	SB	12	12	260	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-130/131	HCS-BG-131	06/22/94	9	11	SB	12	12	270	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-205/206	HCS-BG-205	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-205/206	HCS-BG-206	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA

COC CONCENTRATION-to-SRG RATIOS

Sample ID	VOCs (ug/kg) 1,1-Dichloroethene	VOCs (ug/kg) Tetrachloroethene	VOCs (ug/kg) Trichloroethene	Explosives (ug/kg) HMX	Explosives (ug/kg) Nitroglycerin	Explosives (ug/kg) Perchlorate	Explosives (ug/kg) RDX	Dioxins/ Furans (mg/kg) TEQs	Metals (mg/kg) Copper	Metals (mg/kg) Lead	Metals (mg/kg) Manganese	Metals (mg/kg) Mercury	Maximum Ratio[1]	COC	Other COCs with Ratios > 5
HCS-BG-208			0.06										0.06	--	--
HCS-BG-209		0.15	0.28										0.28	--	--
HCS-BG-210		0.27	0.75										0.75	--	--
HCS-BG-211		0.01	0.03										0.03	--	--
HCS-BG-212		0.03	0.07										0.07	--	--
HCS-BG-213		0.02	0.29										0.29	--	--
HCS-BG-214		0.03	0.69										0.69	--	--
HCS-BG-215			0.11										0.11	--	--
HCS-BG-216			0.08										0.08	--	--
HCS-BG-217			0.02										0.02	--	--
HCS-BG-218		0.03	0.02										0.03	--	--
HCS-BG-219			0.14										0.14	--	--
HCS-BG-220			0.23										0.23	--	--
HCS-BG-221													0.00	--	--
HCS-BG-222													0.00	--	--
HCS-BP-1				0.76			0.66						0.76	--	--
HCS-BP-2				0.46			0.73						0.73	--	--
HCS-BP-3							0.26						0.26	--	--
HCS-BP-4				0.23			0.21						0.23	--	--
HCS-BP-5				0.39			0.51						0.51	--	--
HCS-BP-6				1.40			3.40						3.40	RDX	--
HCS-BP-7				1.20			0.28						1.20	HMX	--
HCS-BP-8							0.28						0.28	--	--
AS01-SB42-(1-2)			0.11					0.01	0.07	0.10	0.94		0.94	--	--
AS01-SB43-(1-2)								0.02	0.04	0.08	0.59		0.59	--	--
AS01-SB44-(1-2)								0.01	0.06	0.09	0.89		0.89	--	--
AS01-SS60-0-0_5			11.3	0.03			0.01	0.42	0.10	0.27	0.74	0.07	11.3	TCE	--
AS01-SB60-1-3			0.81					0.02	0.06	0.09	0.78		0.81	--	--
AS01-SB60-3-5			1.06				0.01	0.04	0.06	0.09	0.72		1.06	TCE	--
AS01-SB60-5-7			5.81					0.03		0.08	0.88		5.81	TCE	--
AS01-SB60-7-8			0.94					0.02		0.08	0.73		0.94	--	--
AS01-SS61-0-0_5							0.01	0.09	0.07	0.16	0.70	0.07	0.70	--	--
AS01-SB61-1-3								0.05	0.07	0.10	0.91	0.06	0.91	--	--
AS01-SB61-3-5								0.04	0.06	0.10	0.72	0.07	0.72	--	--
AS01-SB61-5-7								0.03		0.08	0.82		0.82	--	--
AS01-SB61-7-8								0.06		0.10	0.98		0.98	--	--
AS01-SS62-0-0_5			6.88	0.33		0.09	0.10	0.31	0.04	0.10	0.21	0.04	6.88	TCE	--
AS01-SB62-1-3			156	0.15		0.34	0.21	25.7	0.07	0.09	0.84	0.04	156	TCE	Dioxins
AS01-SB62-3-5			75.0	0.12		0.32	0.45	0.05	0.06	0.09	0.49		75.0	TCE	--
AS01-SB62-5-7		0.25	42.5			0.89		0.02		0.09	0.81		42.5	TCE	--
AS01-SB62-7-8			39.4			0.54		0.04		0.09	0.85		39.4	TCE	--
HCS-BG-5(92)			475										475	TCE	--
HCS-BG-4(92)		3.36	1,000										1,000	TCE	--
HCS-BG-4S			0.58										0.58	--	--
HCS-BG-4(94)									0.07	0.09	0.70		0.70	--	--
HCS-BG-6(92)			0.03										0.03	--	--
HCS-BG-6(94)									1.94	0.06	0.38		1.94	Copper	--
HCS-BG-38		1.50	263										263	TCE	--
HCS-BG-8S			0.36										0.36	--	--
HCS-BG-8									0.07	0.08	0.81		0.81	--	--
HCS-BG-79			2.38										2.38	TCE	--
HCS-BG-120													0.00	--	--
HCS-BG-127			1.44										1.44	TCE	--
HCS-BG-128			1.63										1.63	TCE	--
HCS-BG-131			1.69										1.69	TCE	--
HCS-BG-205													0.00	--	--
HCS-BG-206													0.00	--	--

1 - Red shading indicates maximum ratios >5; orange shading indicates maximum ratios between 1 and 5
Gray shaded concentrations indicate detections; NA - Not Analyzed

Notes:
µg/kg = microgram per kilogram
COC = constituent of concern
ft = foot
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification
mg/kg = miligram per kilogram
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
SRG = site remediation goal
VOC = volatile organic compound

Table 12
Active Burning Grounds - Residential Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATIONS												COC CONCENTRATION-to-SRG RATIOS											
							VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)				VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)			
						RESIDENTIAL SRGs - Surface Soil (SS):	180	220	160	10,000	65,000	850	10,000	2.50E-05	253	160	1,090	1.61												
						RESIDENTIAL SRGs - Subsurface Soil (SB):	180	220	160	N/A	N/A	850	N/A	2.50E-05	N/A	160	852	N/A												
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury
ABG	AS01-SB01	AS01-SS01-R01X	02/21/01	0	1	SS	6	6	6	454	454	66	454	7.69E-05	27.5	39.3	954	0.09								3.08	0.11	0.25	0.88	0.06
ABG	AS01-SB02	AS01-SS02-R01X	02/21/01	0	1	SS	6	6	28	1,190	476	56	735	9.38E-05	22.5	1,730	419	0.08			0.18	0.12			0.07	3.75	0.09	10.8	0.38	0.05
ABG	AS01-SB03	AS01-SS03-R01X	02/21/01	0	1	SS	6	6	6	2,400	476	68	476	7.25E-05	22.4	25.2	912	0.05				0.24		0.08		2.90	0.09	0.16	0.84	0.03
ABG	AS01-SB04	AS01-SS04-R01X	02/21/01	0	1	SS	6	6	9	454	476	96	454	7.30E-05	19.2	34.3	797	0.05			0.06			0.11		2.92	0.08	0.21	0.73	0.03
ABG	AS01-SB05	AS01-SS05-R01X	02/21/01	0	1	SS	6	6	6	2,250	454	880	784	7.71E-05	19.3	55.2	1,010	0.04				0.23		1.04	0.08	3.08	0.08	0.35	0.93	0.02
ABG	AS01-SB06	AS01-SS06-R01X	02/21/01	0	1	SS	6	6	6	476	454	95	476	7.09E-05	19.3	26.9	928	0.05						0.11		2.84	0.08	0.17	0.85	0.03
ABG	AS01-SB07	AS01-SS07-R01X	02/22/01	0	1	SS	6	6	6	417	435	58	417	5.10E-05	20.5	25.9	783	0.05								2.04	0.08	0.16	0.72	0.03
ABG	AS01-SB08	AS01-SS08-R01X	02/21/01	0	1	SS	6	6	6	258	454	63	435	4.86E-05	18.1	30	982	0.05				0.03				1.94	0.07	0.19	0.90	0.03
ABG	AS01-SB09	AS01-SS09-R01X	02/22/01	0	1	SS	6	6	6	454	476	63	454	4.97E-05	21.6	38	1,120	0.08								1.99	0.09	0.24	1.03	0.05
ABG	AS01-SB10	AS01-SS10-R01X	02/22/01	0	1	SS	6	6	6	124	435	61	417	4.87E-05	17.9	29.5	999	0.05				0.01				1.95	0.07	0.18	0.92	0.03
ABG	AS01-SB11	AS01-SS11-R01X	02/22/01	0	1	SS	6	6	3	506	435	58	417	3.85E-05	17.6	96.9	730	0.04			0.02	0.05				1.54	0.07	0.61	0.67	0.02
ABG	AS01-SB12	AS01-SS12-R01X	02/22/01	0	1	SS	6	6	6	130	435	62	454	4.60E-05	19.7	53.4	1,120	0.05				0.01				1.84	0.08	0.33	1.03	0.03
ABG	AS01-SB13	AS01-SS13-R01X	02/22/01	0	1	SS	6	6	6	417	417	64	417	3.31E-05	20.7	25	1,050	0.06								1.32	0.08	0.16	0.96	0.04
ABG	AS01-SB14	AS01-SS14-R01X	02/21/01	0	1	SS	6	6	6	454	454	63	454	6.35E-05	29	101	926	0.06								2.54	0.11	0.63	0.85	0.04
ABG	AS01-SB14	AS01-SB14-R01X	02/21/01	1	2	SS	6	6	6	340	454	120	454	1.83E-04	16.2	15.9	911	0.04				0.03		0.14		7.33	0.06	0.10	0.84	
ABG	AS01-SB15	AS01-SS15-R01X	02/21/01	0	1	SS	6	6	6	454	435	61	454	4.82E-05	27.2	75.8	777	0.06								1.93	0.11	0.47	0.71	0.04
ABG	AS01-SB15	AS01-SB15-R01X	02/21/01	1	2	SS	6	6	6	454	454	61	454	2.12E-04	17.1	20.1	1,030	0.04								8.49	0.07	0.13	0.94	
ABG	AS01-SB16	AS01-SS16-R01X	02/22/01	0	1	SS	6	6	6	454	476	59	454	3.69E-04	17.4	26.6	712	0.04								14.8	0.07	0.17	0.65	0.02
ABG	AS01-SB16	AS01-SB16-R01X	02/22/01	1	2	SS	6	6	5	454	476	62	454	2.00E-04	17.5	16	1,010	0.03			0.03			0.07		7.98	0.07	0.10	0.93	
ABG	AS01-SB17	AS01-SS17-R01X	02/22/01	0	1	SS	6	6	6	417	454	220	417	5.08E-05	17	30.4	813	0.06						0.26		2.03	0.07	0.19	0.75	0.04
ABG	AS01-SB17	AS01-SB17-R01X	02/22/01	1	2	SS	6	6	6	454	476	2,500	454	2.36E-04	16.8	16.7	1,070	0.03						2.94		9.45	0.07	0.10	0.98	
ABG	AS01-SB18	AS01-SS18-R01X	02/22/01	0	1	SS	6	6	6	269	417	62	476	5.01E-05	18.7	134	915	0.38				0.03				2.00	0.07	0.84	0.84	0.24
ABG	AS01-SB18	AS01-SB18-R01X	02/22/01	1	2	SS	6	6	6	476	454	61	476	1.87E-04	16.9	22.1	1,170	0.04								7.50	0.07	0.14	1.07	
ABG	AS01-SB19	AS01-SS19-R01X	02/22/01	0	1	SS	6	6	6	123	417	62	435	3.75E-05	22.8	184	674	0.09				0.01				1.50	0.09	1.15	0.62	0.06
ABG	AS01-SB19	AS01-SB19-R01X	02/22/01	1	2	SS	6	6	6	435	435	60	435	1.58E-04	18.6	25	1,080	0.04								6.33	0.07	0.16	0.99	
ABG	AS01-SB20	AS01-SS20-R01X	02/22/01	0	1	SS	6	6	6	435	454	63	435	1.11E-04	20.7	58.1	1,090	0.08								4.45	0.08	0.36	1.00	0.05
ABG	AS01-SB20	AS01-SB20-R01X	02/22/01	1	2	SS	6	6	6	417	454	59	417	3.82E-05	17.6	16.6	1,100	0.03								1.53	0.07	0.10	1.01	
ABG	AS01-SB63	AS01-SS63-0-0_5	09/22/04	0	0.5	SS	14	14	1.6	190	2,500	54.7	49	9.32E-07	20.7	64.9	941	0.13			0.01	0.02			0.00	0.04	0.08	0.41	0.86	0.08
ABG	AS01-SB63	AS01-SB63-6_5-7	09/22/04	6.5	7	SB	11	11	13	500	2,500	48.5	500	4.94E-07	15.4	13.7	579	0.061			0.08					0.02		0.09	0.68	
ABG	AS01-SB64	AS01-SS64-0-0_5	09/22/04	0	0.5	SS	12	12	12	51,000	98,000	31,300	16,000	3.02E-06	18	16.2	1,120	0.067				5.10	1.51	36.8	1.60	0.12	0.07	0.10	1.03	0.04
ABG	AS01-SB64	AS01-SB64-7_5-8	09/22/04	7.5	8	SB	530	530	600	1,300	2,500	18,800	1,100	5.42E-07	13.7	12.9	600	0.066			3.75			22.1		0.02		0.08	0.70	
ABG	AS01-SB65	AS01-SS65-0-0_5	09/22/04	0	0.5	SS	11	11	66	2,200	2,500	47	1,700	2.35E-06	19.9	65.7	879	0.077			0.41	0.22			0.17	0.09	0.08	0.41	0.81	0.05
ABG	AS01-SB65	AS01-SB65-1_5-2	09/22/04	1.5	2	SS	11	11	140	1,500	2,500	29.7	940	1.31E-06	17	13.7	932	0.075			0.88	0.15		0.03	0.09	0.05	0.07	0.09	0.86	0.05
ABG	AS01-SB66	AS01-SS66-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	52.9	170	2.13E-06	17.6	14.1	1,070	0.066				0.13			0.02	0.09	0.07	0.09	0.98	
ABG	AS01-SB66	AS01-SB66-1_5-2	09/23/04	1.5	2	SS	14	14	14	810	2,500	48.2	96	1.92E-06	16.3	12.8	922	0.06				0.08			0.01	0.08	0.06	0.08	0.85	
ABG	AS01-SB67	AS01-SS67-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	45.4	460	3.28E-06	1,820	138	208	0.092				0.13			0.05	0.13	7.19	0.86	0.19	0.06
ABG	AS01-SB67	AS01-SB67-1_5-2	09/23/04	1.5	2	SS	12	12	11	4,600	2,500	438	69	4.50E-05	24.1	269	546	0.44			0.07	0.46		0.52	0.01	1.80	0.10	1.68	0.50	0.27
ABG	AS01-SB68	AS01-SS68-0-0_5	09/23/04	0	0.5	SS	12	12	12	500	2,500	47.3	500	1.65E-06	17.2	44.4	520	0.06								0.07	0.07	0.28	0.48	0.04
ABG	AS01-SB68	AS01-SB68-1_5-2	09/23/04	1.5	2	SS	610	610	940	5,200	2,000	26.6	74	1.20E-06	36.4	914	692	2			5.88	0.52	0.03	0.03	0.01	0.05	0.14	5.71	0.63	1.24
ABG	AS01-SB69	AS01-SS69-0-0_5	09/23/04	0	0.5	SS	680	420	1,400	20,000	2,500	51.8	2,100	6.01E-06	68.1	106	665	0.16		1.91	8.75	2.00		0.06	0.21	0.24	0.27	0.66	0.61	0.10
ABG	AS01-SB69	AS01-SB69-1-1_5	09/23/04	1	1.5	SS	800	5,800	12,000	570	2,500	91.2	5,200	2.06E-06	20.1	24.6	783	0.45		26.4	75.0	0.06		0.11	0.52	0.08	0.08	0.15	0.72	0.28
ABG	AS01-SB70	AS01-SS70-0-0_5	09/23/04	0	0.5	SS	12	12	38	420	2,500	49.6	210	5.52E-06	18.9	387	543	7.2			0.24	0.04			0.02	0.22	0.07	2.42	0.50	4.47
ABG	AS01-SB70	AS01-SB70-2_5-3	09/23/04	2.5	3	SS	660	660	1,800	2,100	4,500	65	730	3.38E-06	136	1,760	687	0.068			11.3	0.21	0.07	0.08	0.07	0.14	0.54	11.0	0.63	
ABG	BG-010/010S/053	HCS-BG-53	07/13/92	13	14	SB	6	6	480	NA	NA	NA	NA	NA	NA	NA	NA	NA			3.00									
ABG	BG-010/010S/053	HCS-BG-10	07/13/92	3	4	SS	6	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.03									
ABG	BG-010/010S/053	HCS-BG-10S	06/20/94	0	1	SS	11	11	2	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-017/018	HCS-BG-18	07/13/92	10	11	SB	6	6	48	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.30									
ABG	BG-025/025S/048	HCS-BG-25S	06/20/94	0	1	SS	13	13	3	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-033/033S	HCS-BG-33S	06/20/94	0	1	SS	14	14	14	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-034/034S	HCS-BG-34	07/13/92	3	4	SS	6	6	1	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01									
ABG	BG-034/034S	HCS-BG-34S	06/20/94	0	1	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-037	HCS-BG-37	07/13/92	3	4	SS	6	3	37	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.01	0.23									
ABG	BG-055/055S	HCS-BG-55S	06/20/94	0	1	SS	11	11	7	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.04									
ABG	BG-059/050	HCS-BG-50	07/13/92	11	12	SB	6	6	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01									
ABG	BG-067/068	HCS-BG-68	07/13/92	11	12	SB	6	12	30	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.05	0.19									
ABG	BG-132/133	HCS-BG-132	06/22/94	3	5	SS	11	11	89	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.56									
ABG	BG-132/133	HCS-BG-133	11/15/94	2	3	SS	12	12	37	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.23									
ABG	BG-180	HCS-BG-180	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-181	HCS-BG-181	10/27/98	2	3	SS	11	11	34	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.21									
ABG	BG-182/183	HCS-BG-182	10/27/98	2	3	SS	11	11	63	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.39									
ABG	BG-182/183	HCS-BG-183	10/27/98	4	6	SB	12	12	140	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.88									
ABG	BG-184/185	HCS-BG-184	10/27/98	2	3	SS	12	12	26	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.16									
ABG	BG-184/185	HCS-BG-185	10/27/98	4	6	SB	11	11	30	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.19									
ABG	BG-186/187	HCS-BG-186	10/27/98	2	3	SS	11	11	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01									
ABG	BG-186/187	HCS-BG-187	10/27/98	4	6	SB	11	11	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06									
ABG	BG-188/189	HCS-BG-188	10/27/98	2	3	SS	12	12	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06									
ABG	BG-188/189	HCS-BG-189	10/27/98	4	6	SB	12	12	18	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.11									
ABG	BG-190	HCS-BG-190	10/27/98	2	3	SS	12	12	53	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.33									
ABG	BG-191	HCS-BG-191	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-192/193	HCS-BG-192	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-192/193	HCS-BG-193	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-194	HCS-BG-194	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-195	HCS-BG-195	10/27/98	2	3	SS	12	12	74	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.46									
ABG	BG-196/197	HCS-BG-196	10/27/98	2	3	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-196/197	HCS-BG-197	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-198	HCS-BG-198	10/27/98	2	3	SS	12	12	2	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.01									
ABG	BG-199/200	HCS-BG-199	10/27/98	2	3	SS	12	12	29	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.18									
ABG	BG-199/200	HCS-BG-200	10/27/98	4	6	SB	12	12	55	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.34									
ABG	BG-201/202	HCS-BG-201	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-201/202	HCS-BG-202	10/27/98	4	6	SB	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-203/204	HCS-BG-203	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-203/204	HCS-BG-204	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA												
ABG	BG-207/208	HCS-BG-207	10/27/98	2	3	SS	11	11	10	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06									
ABG	BG-207/208	HCS-BG-208	10/27/98	4	6	SB	11	11	9	NA	NA	NA	NA	NA	NA	NA	NA	NA			0.06									
ABG	BG-209/210	HCS-BG-209	10/27/98	2	3	SS	11	32	44	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.15	0.28									
ABG	BG-209/210	HCS-BG-210	10/27/98	4	6	SB	12	60	120	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.27	0.75									
ABG	BG-211/212	HCS-BG-211	10/27/98	2	3	SS	11	3	4	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.01	0.03									
ABG	BG-211/212	HCS-BG-212	10/27/98	4	6	SB	11	6	11	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.03	0.07									
ABG	BG-213/214	HCS-BG-213	10/27/98	2	3	SS	11	5	46	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.02	0.29									
ABG	BG-213/214	HCS-BG-214	10/27/98	4	6	SB	12	6	110	NA	NA	NA	NA	NA	NA	NA	NA	NA		0.03	0.69									

Table 12
Active Burning Grounds - Residential Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

COC CONCENTRATIONS

							VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)			
						RESIDENTIAL SRGs - Surface Soil (SS):	180	220	160	10,000	65,000	850	10,000	2.50E-05	253	160	1,090	1.61
						RESIDENTIAL SRGs - Subsurface Soil (SB):	180	220	160	N/A	N/A	850	N/A	2.50E-05	N/A	160	852	N/A
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury
ABG	BG-215/216	HCS-BG-215	10/27/98	2	3	SS	11	11	18	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-215/216	HCS-BG-216	10/27/98	4	6	SB	11	11	12	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-217/218	HCS-BG-217	10/27/98	2	3	SS	11	11	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-217/218	HCS-BG-218	10/27/98	4	6	SB	11	7	3	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-219/220	HCS-BG-219	10/27/98	2	3	SS	11	11	23	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-219/220	HCS-BG-220	10/27/98	4	6	SB	13	13	37	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-221/222	HCS-BG-221	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BG-221/222	HCS-BG-222	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA
ABG	BP-01	HCS-BP-1	07/13/92	0.5	1	SS	NA	NA	NA	7,600	NA	NA	6,600	NA	NA	NA	NA	NA
ABG	BP-02	HCS-BP-2	07/13/92	0.5	1	SS	NA	NA	NA	4,600	NA	NA	7,300	NA	NA	NA	NA	NA
ABG	BP-03	HCS-BP-3	07/13/92	0.5	1	SS	NA	NA	NA	2,200	NA	NA	2,600	NA	NA	NA	NA	NA
ABG	BP-04	HCS-BP-4	07/13/92	0.5	1	SS	NA	NA	NA	2,300	NA	NA	2,100	NA	NA	NA	NA	NA
ABG	BP-05	HCS-BP-5	07/13/92	0.5	1	SS	NA	NA	NA	3,900	NA	NA	5,100	NA	NA	NA	NA	NA
ABG	BP-06	HCS-BP-6	07/13/92	0.5	1	SS	NA	NA	NA	14,000	NA	NA	34,000	NA	NA	NA	NA	NA
ABG	BP-07	HCS-BP-7	07/13/92	0.5	1	SS	NA	NA	NA	12,000	NA	NA	2,800	NA	NA	NA	NA	NA
ABG	BP-08	HCS-BP-8	07/13/92	0.5	1	SS	NA	NA	NA	2,200	NA	NA	2,800	NA	NA	NA	NA	NA
FDP	AS01-SB42	AS01-SB42-(1-2)	10/24/01	1	2	SS	12	12	18	570	57,000	60	570	2.49E-07	16.9	16.2	1,020	0.12
FDP	AS01-SB43	AS01-SB43-(1-2)	10/24/01	1	2	SS	12	12	12	570	57,000	60	570	4.27E-07	11.1	13	647	0.12
FDP	AS01-SB44	AS01-SB44-(1-2)	10/24/01	1	2	SS	12	12	12	560	56,000	60	560	1.77E-07	15.5	15.1	972	0.11
FDP	AS01-SB60	AS01-SS60-0-0_5	09/21/04	0	0.5	SS	910	910	1,800	250	2,500	54.9	130	1.05E-05	24.1	42.5	810	0.12
FDP	AS01-SB60	AS01-SB60-1-3	09/22/04	1	3	SS	12	12	130	500	2,500	54.6	500	4.93E-07	15.8	14.2	853	0.068
FDP	AS01-SB60	AS01-SB60-3-5	09/22/04	3	5	SS	11	11	170	500	2,500	48.1	58	9.69E-07	14.6	13.8	790	0.06
FDP	AS01-SB60	AS01-SB60-5-7	09/22/04	5	7	SB	510	510	930	500	2,500	46.4	53	7.74E-07	13.3	13.4	753	0.099
FDP	AS01-SB60	AS01-SB60-7-8	09/22/04	7	8	SB	12	12	150	500	2,500	48.9	500	5.26E-07	11.8	12.3	624	0.097
FDP	AS01-SB61	AS01-SS61-0-0_5	09/21/04	0	0.5	SS	18	18	18	500	2,500	106	96	2.29E-06	18.5	25	762	0.11
FDP	AS01-SB61	AS01-SB61-1-3	09/22/04	1	3	SS	13	13	13	500	2,500	53.9	500	1.35E-06	16.7	15.3	995	0.095
FDP	AS01-SB61	AS01-SB61-3-5	09/22/04	3	5	SS	11	11	11	500	2,500	49.5	500	1.09E-06	14.7	15.4	783	0.12
FDP	AS01-SB61	AS01-SB61-5-7	09/22/04	5	7	SB	12	12	12	500	2,500	46.5	500	8.04E-07	15.4	13.2	701	0.063
FDP	AS01-SB61	AS01-SB61-7-8	09/22/04	7	8	SB	12	12	12	500	2,500	47.7	500	1.39E-06	15.8	16.5	833	0.06
FDP	AS01-SB62	AS01-SS62-0-0_5	09/21/04	0	0.5	SS	710	710	1,100	3,300	2,500	74	1,000	7.67E-06	10.5	16.3	228	0.067
FDP	AS01-SB62	AS01-SB62-1-3	09/22/04	1	3	SS	12,000	12,000	25,000	1,500	2,500	288	2,100	6.42E-04	17.3	14.5	918	0.062
FDP	AS01-SB62	AS01-SB62-3-5	09/22/04	3	5	SS	11,000	11,000	12,000	1,200	2,500	269	4,500	1.30E-06	16.3	13.8	532	0.06
FDP	AS01-SB62	AS01-SB62-5-7	09/22/04	5	7	SB	480	55	6,800	750	2,500	757	5,500	4.70E-07	17.3	14.6	686	0.07
FDP	AS01-SB62	AS01-SB62-7-8	09/22/04	7	8	SB	530	530	6,300	350	2,500	459	3,600	9.09E-07	15.3	15.1	725	0.086
FDP	BG-004/004S/005/039	HCS-BG-5(92)	07/13/92	10	11	SB	4,500	4,500	76,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-004/004S/005/039	HCS-BG-4(92)	07/13/92	3	4	SS	760	740	160,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-004/004S/005/039	HCS-BG-4S	06/20/94	0	1	SS	12	12	93	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-004/004S/005/039	HCS-BG-4(94)	06/20/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	17	14.8	761	0.08
FDP	BG-006/007	HCS-BG-6(92)	07/13/92	3	4	SS	6	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-006/007	HCS-BG-6(94)	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	492	9	409	0.06
FDP	BG-008/008S/009/038	HCS-BG-38	07/13/92	12.5	13.5	SB	740	330	42,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-008/008S/009/038	HCS-BG-8S	06/20/94	0	1	SS	11	11	57	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-008/008S/009/038	HCS-BG-8	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	16.7	13.4	886	0.07
FDP	BG-079	HCS-BG-79	07/13/92	11	12	SB	6	6	380	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-120/121	HCS-BG-120	06/21/94	3	5	SS	12	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-126/127	HCS-BG-127	06/22/94	9	11	SB	12	12	230	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-128/129	HCS-BG-128	06/22/94	9	11	SB	12	12	260	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-130/131	HCS-BG-131	06/22/94	9	11	SB	12	12	270	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-205/206	HCS-BG-205	10/27/98	2	3	SS	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-205/206	HCS-BG-206	10/27/98	4	6	SB	11	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA

COC CONCENTRATION-to-SRG RATIOS

			VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)			
Area	Station ID	Sample ID	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury
ABG	BG-215/216	HCS-BG-215			0.11									
ABG	BG-215/216	HCS-BG-216			0.08									
ABG	BG-217/218	HCS-BG-217			0.02									
ABG	BG-217/218	HCS-BG-218		0.03	0.02									
ABG	BG-219/220	HCS-BG-219			0.14									
ABG	BG-219/220	HCS-BG-220			0.23									
ABG	BG-221/222	HCS-BG-221												
ABG	BG-221/222	HCS-BG-222												
ABG	BP-01	HCS-BP-1				0.76			0.66					
ABG	BP-02	HCS-BP-2				0.46			0.73					
ABG	BP-03	HCS-BP-3							0.26					
ABG	BP-04	HCS-BP-4				0.23			0.21					
ABG	BP-05	HCS-BP-5				0.39			0.51					
ABG	BP-06	HCS-BP-6				**1.40**			**3.40**					
ABG	BP-07	HCS-BP-7				**1.20**			0.28					
ABG	BP-08	HCS-BP-8							0.28					
FDP	AS01-SB42	AS01-SB42-(1-2)			0.11					0.01	0.07	0.10	0.94	
FDP	AS01-SB43	AS01-SB43-(1-2)								0.02	0.04	0.08	0.59	
FDP	AS01-SB44	AS01-SB44-(1-2)								0.01	0.06	0.09	0.89	
FDP	AS01-SB60	AS01-SS60-0-0_5			**11.3**	0.03			0.01	0.42	0.10	0.27	0.74	0.07
FDP	AS01-SB60	AS01-SB60-1-3			0.81					0.02	0.06	0.09	0.78	
FDP	AS01-SB60	AS01-SB60-3-5			**1.06**				0.01	0.04	0.06	0.09	0.72	
FDP	AS01-SB60	AS01-SB60-5-7			**5.81**					0.03		0.08	0.88	
FDP	AS01-SB60	AS01-SB60-7-8			0.94					0.02		0.08	0.73	
FDP	AS01-SB61	AS01-SS61-0-0_5							0.01	0.09	0.07	0.16	0.70	0.07
FDP	AS01-SB61	AS01-SB61-1-3								0.05	0.07	0.10	0.91	0.06
FDP	AS01-SB61	AS01-SB61-3-5								0.04	0.06	0.10	0.72	0.07
FDP	AS01-SB61	AS01-SB61-5-7								0.03		0.08	0.82	
FDP	AS01-SB61	AS01-SB61-7-8								0.06		0.10	0.98	
FDP	AS01-SB62	AS01-SS62-0-0_5			**6.88**	0.33		0.09	0.10	0.31	0.04	0.10	0.21	0.04
FDP	AS01-SB62	AS01-SB62-1-3			**156**	0.15		0.34	0.21	**25.7**	0.07	0.09	0.84	0.04
FDP	AS01-SB62	AS01-SB62-3-5			**75.0**	0.12		0.32	0.45	0.05	0.06	0.09	0.49	
FDP	AS01-SB62	AS01-SB62-5-7		0.25	**42.5**			0.89		0.02		0.09	0.81	
FDP	AS01-SB62	AS01-SB62-7-8			**39.4**			0.54		0.04		0.09	0.85	
FDP	BG-004/004S/005/039	HCS-BG-5(92)			**475**									
FDP	BG-004/004S/005/039	HCS-BG-4(92)		**3.36**	**1,000**									
FDP	BG-004/004S/005/039	HCS-BG-4S			0.58									
FDP	BG-004/004S/005/039	HCS-BG-4(94)									0.07	0.09	0.70	
FDP	BG-006/007	HCS-BG-6(92)			0.03									
FDP	BG-006/007	HCS-BG-6(94)									**1.94**	0.06	0.38	
FDP	BG-008/008S/009/038	HCS-BG-38		**1.50**	**263**									
FDP	BG-008/008S/009/038	HCS-BG-8S			0.36									
FDP	BG-008/008S/009/038	HCS-BG-8									0.07	0.08	0.81	
FDP	BG-079	HCS-BG-79			**2.38**									
FDP	BG-120/121	HCS-BG-120												
FDP	BG-126/127	HCS-BG-127			**1.44**									
FDP	BG-128/129	HCS-BG-128			**1.63**									
FDP	BG-130/131	HCS-BG-131			**1.69**									
FDP	BG-205/206	HCS-BG-205												
FDP	BG-205/206	HCS-BG-206												

Table 12
Active Burning Grounds - Residential Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

COC CONCENTRATIONS

Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury
							VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)			
						RESIDENTIAL SRGs - Surface Soil (SS):	180	220	160	10,000	65,000	850	10,000	2.50E-05	253	160	1,090	1.61
						RESIDENTIAL SRGs - Subsurface Soil (SB):	180	220	160	N/A	N/A	850	N/A	2.50E-05	N/A	160	852	N/A
						UCL Current Conditions	--	361	11,613	5,948	98,000	3,575	2,604	1.16E-04	183	287	864	0.454
STEP 1 (SRG Ratio >10)																		
FDP	BG-004/004S/005/039	HCS-BG-4(92)	07/13/92	3	4	SS	760	740	160,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-004/004S/005/039	HCS-BG-4S	06/20/94	0	1	SS	12	12	93	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-004/004S/005/039	HCS-BG-5(92)	07/13/92	10	11	SB	4,500	4,500	76,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-004/004S/005/039	HCS-BG-4(94)	06/20/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	17	14.8	761	0.08
FDP	BG-008/008S/009/038	HCS-BG-38	07/13/92	12.5	13.5	SB	740	330	42,000	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	BG-008/008S/009/038	HCS-BG-8	06/21/94	3	5	SS	NA	NA	NA	NA	NA	NA	NA	NA	16.7	13.4	886	0.07
FDP	BG-008/008S/009/038	HCS-BG-8S	06/20/94	0	1	SS	11	11	57	NA	NA	NA	NA	NA	NA	NA	NA	NA
FDP	AS01-SB62	AS01-SB62-1-3	09/22/04	1	3	SS	12,000	12,000	25,000	1,500	2,500	288	2,100	6.42E-04	17.3	14.5	918	0.062
FDP	AS01-SB62	AS01-SS62-0-0_5	09/21/04	0	0.5	SS	710	710	1,100	3,300	2,500	74	1,000	7.67E-06	10.5	16.3	228	0.067
ABG	AS01-SB69	AS01-SB69-1-1_5	09/23/04	1	1.5	SS	800	5,800	12,000	570	2,500	91.2	5,200	2.06E-06	20.1	24.6	783	0.45
ABG	AS01-SB69	AS01-SS69-0-0_5	09/23/04	0	0.5	SS	680	420	1,400	20,000	2,500	51.8	2,100	6.01E-06	68.1	106	665	0.16
FDP	AS01-SB62	AS01-SB62-3-5	09/22/04	3	5	SS	11,000	11,000	12,000	1,200	2,500	269	4,500	1.30E-06	16.3	13.8	532	0.06
FDP	AS01-SB62	AS01-SB62-5-7	09/22/04	5	7	SB	480	55	6,800	750	2,500	757	5,500	4.70E-07	17.3	14.6	686	0.07
FDP	AS01-SB62	AS01-SB62-7-8	09/22/04	7	8	SB	530	530	6,300	350	2,500	459	3,600	9.09E-07	15.3	15.1	725	0.086
ABG	AS01-SB64	AS01-SS64-0-0_5	09/22/04	0	0.5	SS	12	12	12	51,000	98,000	31,300	16,000	3.02E-06	18	16.2	1,120	0.067
ABG	AS01-SB64	AS01-SB64-7_5-8	09/22/04	7.5	8	SB	530	530	600	1,300	2,500	18,800	1,100	5.42E-07	13.7	12.9	600	0.066
ABG	AS01-SB16	AS01-SS16-R01X	02/22/01	0	1	SS	6	6	6	454	476	59	454	3.69E-04	17.4	26.6	712	0.04
ABG	AS01-SB70	AS01-SB70-2_5-3	09/23/04	2.5	3	SS	660	660	1,800	2,100	4,500	65	730	3.38E-06	136	1,760	687	0.068
ABG	AS01-SB70	AS01-SS70-0-0_5	09/23/04	0	0.5	SS	12	12	38	420	2,500	49.6	210	5.52E-06	18.9	387	543	7.2
FDP	AS01-SB60	AS01-SS60-0-0_5	09/21/04	0	0.5	SS	910	910	1,800	250	2,500	54.9	130	1.05E-05	24.1	42.5	810	0.12
ABG	AS01-SB02	AS01-SS02-R01X	02/21/01	0	1	SS	6	6	28	1,190	476	56	735	9.38E-05	22.5	1,730	419	0.08
						UCL Step 1	--	6.77	136	2,023	--	244	2,380	1.08E-04	234	146	911	0.200
						Maximum - All depths	--	60.0	940	14,000	2,000	2,500	34,000	2.36E-04	1,820	914	1,170	2.00
						Maximum - SS	--	32.0	940	14,000	2,000	2,500	34,000	2.36E-04	1,820	914	1,170	2.00
						Ecological PRG	--	--	--	10,000	65,000	1,000	10,000	--	253	785	--	1.61
						Maximum ratio	--	--	--	1.40	0.03	2.50	3.40	--	7.19	1.16	--	1.24
STEP 2 (SRG Ratio >5)																		
ABG	AS01-SB17	AS01-SB17-R01X	02/22/01	1	2	SS	6	6	6	454	476	2,500	454	2.36E-04	16.8	16.7	1,070	0.03
ABG	AS01-SB17	AS01-SS17-R01X	02/22/01	0	1	SS	6	6	6	417	454	220	417	5.08E-05	17	30.4	813	0.06
ABG	AS01-SB15	AS01-SB15-R01X	02/21/01	1	2	SS	6	6	6	454	454	61	454	2.12E-04	17.1	20.1	1,030	0.04
ABG	AS01-SB15	AS01-SS15-R01X	02/21/01	0	1	SS	6	6	6	454	435	61	454	4.82E-05	27.2	75.8	777	0.06
ABG	AS01-SB16	AS01-SB16-R01X	02/22/01	1	2	SS	6	6	5	454	476	62	454	2.00E-04	17.5	16	1,010	0.03
ABG	AS01-SB18	AS01-SB18-R01X	02/22/01	1	2	SS	6	6	6	476	454	61	476	1.87E-04	16.9	22.1	1,170	0.04
ABG	AS01-SB18	AS01-SS18-R01X	02/22/01	0	1	SS	6	6	6	269	417	62	476	5.01E-05	18.7	134	915	0.38
ABG	AS01-SB14	AS01-SB14-R01X	02/21/01	1	2	SS	6	6	6	340	454	120	454	1.83E-04	16.2	15.9	911	0.04
ABG	AS01-SB14	AS01-SS14-R01X	02/21/01	0	1	SS	6	6	6	454	454	63	454	6.35E-05	29	101	926	0.06
ABG	AS01-SB67	AS01-SS67-0-0_5	09/23/04	0	0.5	SS	13	13	13	1,300	2,500	45.4	460	3.28E-06	1,820	138	208	0.092
ABG	AS01-SB19	AS01-SB19-R01X	02/22/01	1	2	SS	6	6	6	435	435	60	435	1.58E-04	18.6	25	1,080	0.04
ABG	AS01-SB19	AS01-SS19-R01X	02/22/01	0	1	SS	6	6	6	123	417	62	435	3.75E-05	22.8	184	674	0.09
ABG	AS01-SB68	AS01-SB68-1_5-2	09/23/04	1.5	2	SS	610	610	940	5,200	2,000	26.6	74	1.20E-06	36.4	914	692	2
ABG	AS01-SB68	AS01-SS68-0-0_5	09/23/04	0	0.5	SS	12	12	12	500	2,500	47.3	500	1.65E-06	17.2	44.4	520	0.06
FDP	AS01-SB60	AS01-SB60-5-7	09/22/04	5	7	SB	510	510	930	500	2,500	46.4	53	7.74E-07	13.3	13.4	753	0.099
FDP	AS01-SB60	AS01-SB60-3-5	09/22/04	3	5	SS	11	11	170	500	2,500	48.1	58	9.69E-07	14.6	13.8	790	0.06
FDP	AS01-SB60	AS01-SB60-1-3	09/22/04	1	3	SS	12	12	130	500	2,500	54.6	500	4.93E-07	15.8	14.2	853	0.068
						UCL Step 2	--	6.93	51.0	2,626	--	134	3,402	6.72E-05	100	74.7	933	0.101
						Maximum - All depths	--	60.0	480	14,000	--	880	34,000	1.11E-04	492	269	1,120	0.44
						Maximum - SS	--	32.0	140	14,000	--	880	34,000	1.11E-04	492	269	1,120	0.44
						Ecological PRG	--	--	--	10,000	65,000	1,000	10,000	--	253	785	--	1.61
						Maximum ratio	--	--	--	1.40	--	0.88	3.40	--	1.94	0.34	--	0.27
STEP 3 (Dioxins)																		
ABG	AS01-SB20	AS01-SS20-R01X	02/22/01	0	1	SS	6	6	6	435	454	63	435	1.11E-04	20.7	58.1	1,090	0.08
ABG	AS01-SB05	AS01-SS05-R01X	02/21/01	0	1	SS	6	6	6	2,250	454	880	784	7.71E-05	19.3	55.2	1,010	0.04
ABG	AS01-SB01	AS01-SS01-R01X	02/21/01	0	1	SS	6	6	6	454	454	66	454	7.69E-05	27.5	39.3	954	0.09
ABG	AS01-SB04	AS01-SS04-R01X	02/21/01	0	1	SS	6	6	9	454	476	96	454	7.30E-05	19.2	34.3	797	0.05
ABG	AS01-SB03	AS01-SS03-R01X	02/21/01	0	1	SS	6	6	6	2,400	476	68	476	7.25E-05	22.4	25.2	912	0.05
ABG	AS01-SB06	AS01-SS06-R01X	02/21/01	0	1	SS	6	6	6	476	454	95	476	7.09E-05	19.3	26.9	928	0.05
ABG	AS01-SB07	AS01-SS07-R01X	02/22/01	0	1	SS	6	6	6	417	435	58	417	5.10E-05	20.5	25.9	783	0.05
ABG	AS01-SB09	AS01-SS09-R01X	02/22/01	0	1	SS	6	6	6	454	476	63	454	4.97E-05	21.6	38	1,120	0.08
ABG	AS01-SB10	AS01-SS10-R01X	02/22/01	0	1	SS	6	6	6	124	435	61	417	4.87E-05	17.9	29.5	999	0.05
ABG	AS01-SB08	AS01-SS08-R01X	02/21/01	0	1	SS	6	6	6	258	454	63	435	4.86E-05	18.1	30	982	0.05
ABG	AS01-SB12	AS01-SS12-R01X	02/22/01	0	1	SS	6	6	6	130	435	62	454	4.60E-05	19.7	53.4	1,120	0.05
ABG	AS01-SB67	AS01-SB67-1_5-2	09/23/04	1.5	2	SS	12	12	11	4,600	2,500	438	69	4.50E-05	24.1	269	546	0.44
ABG	AS01-SB11	AS01-SS11-R01X	02/22/01	0	1	SS	6	6	3	506	435	58	417	3.85E-05	17.6	96.9	730	0.04
						UCL Step 3								1.74E-05				
						Maximum - All depths	--	60.0	480	14,000	--	29.7	34,000	3.82E-05	492	65.7	1,100	0.130
						Maximum - SS	--	32.0	140	14,000	--	29.7	34,000	3.82E-05	492	65.7	1,100	0.130
						Ecological PRG	--	--	--	10,000	65,000	1,000	10,000	--	253	785	--	1.61
						Maximum ratio	--	--	--	1.40	--	0.03	3.40	--	1.94	0.08	--	0.08

COC CONCENTRATION-to-SRG RATIOS

Sample ID	1,1-Dichloroethene	Tetrachloroethene	Trichloroethene	HMX	Nitroglycerin	Perchlorate	RDX	TEQs	Copper	Lead	Manganese	Mercury
	VOCs (ug/kg)			Explosives (ug/kg)				Dioxins/ Furans (mg/kg)	Metals (mg/kg)			
STEP 1 (SRG Ratio >10)												
HCS-BG-4(92)		3.36	1,000									
HCS-BG-4S			0.58									
HCS-BG-5(92)			475									
HCS-BG-4(94)									0.07	0.09	0.70	
HCS-BG-38		1.50	263									
HCS-BG-8									0.07	0.08	0.81	
HCS-BG-8S			0.36									
AS01-SB62-1-3			156	0.15		0.34	0.21	25.7	0.07	0.09	0.84	0.04
AS01-SS62-0-0_5			6.88	0.33		0.09	0.10	0.31	0.04	0.10	0.21	0.04
AS01-SB69-1-1_5		26.4	75.0	0.06		0.11	0.52	0.08	0.08	0.15	0.72	0.28
AS01-SS69-0-0_5		1.91	8.75	2.00		0.06	0.21	0.24	0.27	0.66	0.61	0.10
AS01-SB62-3-5			75.0	0.12		0.32	0.45	0.05	0.06	0.09	0.49	
AS01-SB62-5-7		0.25	42.5			0.89		0.02		0.09	0.81	
AS01-SB62-7-8			39.4			0.54		0.04		0.09	0.85	
AS01-SS64-0-0_5				5.10	1.51	36.8	1.60	0.12	0.07	0.10	1.03	0.04
AS01-SB64-7_5-8			3.75			22.1		0.02		0.08	0.70	
AS01-SS16-R01X								14.8	0.07	0.17	0.65	0.02
AS01-SB70-2_5-3			11.3	0.21	0.07	0.08	0.07	0.14	0.54	11.0	0.63	
AS01-SS70-0-0_5			0.24	0.04			0.02	0.22	0.07	2.42	0.50	4.47
AS01-SS60-0-0_5			11.3	0.03			0.01	0.42	0.10	0.27	0.74	0.07
AS01-SS02-R01X			0.18	0.12			0.07	3.75	0.09	10.8	0.38	0.05
UCL Step 1												
Maximum - All depths	--	0.27	5.88	1.40	0.03	2.94	3.40	9.45	7.19	5.71	1.07	1.24
Maximum - SS	--	0.15	5.88	1.40	0.03	2.94	3.40	9.45	7.19	5.71	1.07	1.24
STEP 2 (SRG Ratio >5)												
AS01-SB17-R01X						2.94		9.45	0.07	0.10	0.98	
AS01-SS17-R01X						0.26		2.03	0.07	0.19	0.75	0.04
AS01-SB15-R01X								8.49	0.07	0.13	0.94	
AS01-SS15-R01X								1.93	0.11	0.47	0.71	0.04
AS01-SB16-R01X			0.03			0.07		7.98	0.07	0.10	0.93	
AS01-SB18-R01X								7.50	0.07	0.14	1.07	
AS01-SS18-R01X				0.03				2.00	0.07	0.84	0.84	0.24
AS01-SB14-R01X				0.03		0.14		7.33	0.06	0.10	0.84	
AS01-SS14-R01X								2.54	0.11	0.63	0.85	0.04
AS01-SS67-0-0_5				0.13			0.05	0.13	7.19	0.86	0.19	0.06
AS01-SB19-R01X								6.33	0.07	0.16	0.99	
AS01-SS19-R01X				0.01				1.50	0.09	1.15	0.62	0.06
AS01-SB68-1_5-2			5.88	0.52	0.03	0.03	0.01	0.05	0.14	5.71	0.63	1.24
AS01-SS68-0-0_5								0.07	0.07	0.28	0.48	0.04
AS01-SB60-5-7			5.81					0.03		0.08	0.88	
AS01-SB60-3-5			1.06				0.01	0.04	0.06	0.09	0.72	
AS01-SB60-1-3			0.81					0.02	0.06	0.09	0.78	
UCL Step 2												
Maximum - All depths	--	0.27	3.00	1.40	--	1.04	3.40	4.45	1.94	1.68	1.03	0.27
Maximum - SS	--	0.15	0.88	1.40	--	1.04	3.40	4.45	1.94	1.68	1.03	0.27
STEP 3 (Dioxins)												
AS01-SS20-R01X								4.45	0.08	0.36	1.00	0.05
AS01-SS05-R01X				0.23		1.04	0.08	3.08	0.08	0.35	0.93	0.02
AS01-SS01-R01X								3.08	0.11	0.25	0.88	0.06
AS01-SS04-R01X			0.06			0.11		2.92	0.08	0.21	0.73	0.03
AS01-SS03-R01X				0.24		0.08		2.90	0.09	0.16	0.84	0.03
AS01-SS06-R01X						0.11		2.84	0.08	0.17	0.85	0.03
AS01-SS07-R01X								2.04	0.08	0.16	0.72	0.03
AS01-SS09-R01X								1.99	0.09	0.24	1.03	0.05
AS01-SS10-R01X				0.01				1.95	0.07	0.18	0.92	0.03
AS01-SS08-R01X				0.03				1.94	0.07	0.19	0.90	0.03
AS01-SS12-R01X				0.01				1.84	0.08	0.33	1.03	0.03
AS01-SB67-1_5-2			0.07	0.46		0.52	0.01	1.80	0.10	1.68	0.50	0.27
AS01-SS11-R01X			0.02	0.05				1.54	0.07	0.61	0.67	0.02
UCL Step 3												
Maximum - All depths	--	0.27	3.00	1.40	--	0.03	3.40	1.53	1.94	0.41	1.01	0.08
Maximum - SS	--	0.15	0.88	1.40	--	0.03	3.40	1.53	1.94	0.41	1.01	0.08

Gray shaded concentrations indicate detections; NA - Not Analyzed

Notes:
µg/kg = microgram per kilogram
COC = constituent of concern
ft = foot
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification
mg/kg = milligram per kilogram
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
SRG = site remediation goal
VOC = volatile organic compound

Table 13
Outside Active Burning Grounds - Industrial Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATIONS																									
							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
						INDUSTRIAL SRGs - Surface Soil (SS):	450	300	1,100	810	8,800	2,100	21,000	2,100	29,000	18,000	10,000	370	120	9.60E-05	16.0	17.4	42.7	52.3	253	35,600	785	1.61	78.4	42.6	173	1,170
						INDUSTRIAL SRGs - Subsurface Soil (SB):	8,400	N/A	1,100	810	8,800	2,100	21,000	2,100	N/A	N/A	N/A	370	120	1.80E-04	16.0	130	N/A	20.9	11,000	33,000	830	39.0	N/A	N/A	N/A	N/A
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (tota	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
W-OABG	22C-1	22C-1-T	10/26/95	0	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	52	52	NA	6.6	2.7	19.3	10.6	25.6	28,300	74.9	0.42	21.4	7.7	18.9	123
W-OABG	22C-2	22C-2-T	10/26/95	0	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38	38	NA	1.5	0.58	7	1.6	5.2	6,820	6.5	0.06	2.3	1.6	10.3	23.6
W-OABG	22D-1	22D-1-D	10/26/95	2	4	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.5	1.1	13.6	13	22.1	26,900	22.1	0.55	17	0.82	21.6	88.6
W-OABG	22D-1	22D-1-T	10/26/95	0	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.3	2	22	5	33.9	12,400	80.1	5.3	8.4	11.6	15.9	261
W-OABG	AOCM-1	AOCM-1-T	10/26/01	0	1	SS	NA	14	14	14	140	130	160	460	1,714	1,291	NA	NA	NA	NA	16.6	0.84	15.6	42.8	46	31,200	53.3	0.34	60.9	2.6	37.1	220
W-OABG	AOCM-2	AOCM-2-T	10/26/01	0	1	SS	NA	13	13	13	100	83	100	420	1,708	867	NA	NA	NA	NA	9.6	0.76	13	24	33.3	20,600	43.5	0.31	38.2	2	41.2	144
E-OABG	AS01-SB21	AS01-SS21-(0-1)	10/25/01	0	1	SS	NA	12	12	82,000	61	55	97	390	1,605	1,082	NA	NA	NA	NA	13.1	12.4	43.3	23.7	526	33,800	1,120	4.7	47.4	70.3	44.6	1,030
E-OABG	AS01-SB22	AS01-SS22-(0-1)	10/25/01	0	1	SS	NA	11	11	65,000	78	79	110	380	1,580	1,049	NA	NA	NA	NA	19.3	6.5	224	34.5	1,080	57,900	337	2.5	240	61	332	1,360
W-OABG	AS01-SB23	AS01-SS23-(0-1)	10/26/01	0	1	SS	NA	12	12	12	110	120	190	390	1,685	1,146	NA	NA	NA	NA	10.2	0.69	22.5	18.9	57.4	24,700	46	0.24	29.3	12.1	24.3	235
W-OABG	AS01-SB24	AS01-SB24-(1-2)	10/24/01	1	2	SS	NA	11	11	11	350	350	350	350	1,195	1,575	NA	NA	NA	NA	11.9	0.67	12.3	24.3	50.7	20,900	59.1	0.26	34.1	1.1	12.6	148
W-OABG	AS01-SB24	AS01-SS24-(0-1)	10/24/01	0	1	SS	NA	11	11	11	760	680	840	51	3,682	6,291	NA	NA	NA	NA	14.4	0.77	11.6	58.2	41	25,800	42.4	0.29	79.5	1.8	16.5	231
W-OABG	AS01-SB25	AS01-SB25-(1-2)	10/24/01	1	2	SS	NA	11	11	11	58,000	55,000	65,000	2,100	240,060	492,100	NA	NA	NA	NA	7.3	0.64	10	16.2	27.8	16,900	21.8	0.45	25	1.9	10.4	131
W-OABG	AS01-SB25	AS01-SS25-(0-1)	10/24/01	0	1	SS	NA	12	12	12	680	750	970	390	3,453	6,205	NA	NA	NA	NA	18.2	0.93	15.4	55.6	48.2	32,300	47.6	0.28	77.3	4	22.2	246
W-OABG	AS01-SB26	AS01-SB26-(1-2)	10/23/01	1	2	SS	NA	12	12	25,000	130	130	170	400	1,760	1,338	NA	NA	NA	NA	20.6	0.72	20.8	28	64.9	36,500	73.4	0.7	42.1	1.2	21.4	212
W-OABG	AS01-SB26	AS01-SS26-(0-1)	10/23/01	0	1	SS	NA	13	13	120	180	160	240	430	1,867	2,109	NA	NA	NA	NA	18.4	0.77	17.9	43.9	55.2	34,500	55.1	0.18	83.7	1.3	25.7	207
W-OABG	AS01-SB27	AS01-SB27-(1-2)	10/23/01	1	2	SS	NA	12	12	12	180	190	330	360	1,314	1,916	NA	NA	NA	NA	14.7	0.72	16.8	20.4	37.3	31,500	38.7	0.35	28.7	1.2	19.7	127
W-OABG	AS01-SB27	AS01-SS27-(0-1)	10/23/01	0	1	SS	NA	14	14	18	180	170	260	420	1,781	1,832	NA	NA	NA	NA	11	0.8	11.4	38.7	40.2	21,900	46.7	0.14	56	1.3	16.3	168
W-OABG	AS01-SB28	AS01-SS28-(0-1)	10/26/01	0	1	SS	NA	12	12	9.1	100	100	120	410	1,765	970	NA	NA	NA	NA	13	0.74	12.6	41.8	37.4	26,800	42.2	0.69	59.5	1.2	18.8	176
E-OABG	AS01-SB29	AS01-SS29-(0-1)	10/26/01	0	1	SS	NA	13	13	13	83	84	98	420	1,740	1,228	620	62,000	620	NA	14.4	0.75	13.4	39.7	35.6	26,800	45.3	0.16	54	1.3	23.2	161
E-OABG	AS01-SB30	AS01-SB30-(1-2)	10/24/01	1	2	SS	NA	12	6.1	13,000	370	330	320	390	2,314	3,165	590	59,000	590	1.22E-05	31	12.4	112	40.3	332	122,000	2,540	4.5	63.6	43.1	26.6	999
E-OABG	AS01-SB30	AS01-SS30-(0-1)	10/24/01	0	1	SS	NA	14	14	26	220	240	290	440	1,844	2,286	670	67,000	670	3.72E-06	10.5	0.82	9.5	51.1	36.2	18,900	38.1	0.14	75.4	1.4	13.4	206
W-OABG	AS01-SB33	AS01-SS33-(0-1)	10/26/01	0	1	SS	NA	12	12	12	250	220	270	410	2,120	1,931	610	61,000	610	1.36E-05	17.9	0.75	15.3	41.7	45	33,600	40.8	0.18	58.3	1.7	20.7	189
W-OABG	AS01-SB34	AS01-SB34-(1-2)	10/25/01	1	2	SS	NA	12	12	23	210	190	280	390	1,570	2,116	600	60,000	600	7.28E-05	15.0	12.6	37.1	40.7	999	40,900	210	0.57	73.7	95.3	80.3	1,080
W-OABG	AS01-SB34	AS01-SS34-(0-1)	10/25/01	0	1	SS	NA	13	13	4.4	340	340	380	420	1,811	3,020	630	63,000	630	NA	16.5	0.93	15.0	60	59.8	32,300	49.7	0.41	78.9	9.8	21.4	283
W-OABG	AS01-SB35	AS01-SS35-(0-1)	10/26/01	0	1	SS	NA	12	12	12	160	180	120	400	1,485	1,440	580	58,000	580	5.54E-06	13.8	0.72	13	39.3	37.5	27,800	47.2	0.18	54.5	1.7	18.9	186
W-OABG	AS01-SB36	AS01-SB36-(1-2)	10/25/01	1	2	SS	NA	11	11	11	60	62	55	360	1466	817	540	54,000	540	1.43E-05	10	1.3	12.5	15.6	46.5	24,400	44.3	0.14	22.9	6	13.5	220
W-OABG	AS01-SB36	AS01-SS36-(0-1)	10/25/01	0	1	SS	NA	13	13	13	100	100	150	430	1,560	1,281	650	65,000	650	1.78E-05	17.9	0.78	16.5	41	44.9	34,800	48.3	0.18	56.7	1.3	22.6	204
W-OABG	AS01-SB37	AS01-SS37-(0-1)	10/26/01	0	1	SS	NA	13	13	13	160	150	260	420	1,692	1,460	620	62,000	620	2.34E-05	12.9	0.75	20.7	29.5	161	25,000	103	0.28	47	3	32.2	362
W-OABG	AS01-SB38	AS01-SB38-(1-2)	10/26/01	1	2	SS	NA	11	11	11	170	170	190	370	1,529	1,506	560	56,000	560	7.43E-07	10.7	0.67	14	15.2	23.1	28,300	28.2	0.11	18.8	1.1	19.5	78.1
W-OABG	AS01-SB38	AS01-SS38-(0-1)	10/26/01	0	1	SS	NA	12	12	12	150	150	200	390	1,695	1,488	590	59,000	590	1.84E-05	9.1	0.7	13.5	21.5	27.8	20,700	37.1	0.12	31.8	1.2	21.8	108
W-OABG	AS01-SB39	AS01-SB39-(1-2)	10/23/01	1	2	SS	NA	12	12	16,000	310	310	360	380	2,118	2,980	NA	NA	NA	NA	21.5	0.8	23.9	28.4	72	34,200	88.6	0.79	43.1	1.2	20.7	226
W-OABG	AS01-SB39	AS01-SS39-(0-1)	10/23/01	0	1	SS	NA	13	13	180	120	110	170	380	1,530	1,286	NA	NA	NA	NA	13.1	0.78	12.3	38.3	37.5	23,100	43.3	0.12	54.5	1.3	16.1	165
E-OABG	AS01-SB40	AS01-SB40-(1-2)	10/24/01	1	2	SS	NA	12	8.9	15	300	310	440	370	2,248	3,195	580	58,000	580	5.86E-06	10	0.69	13.1	19.6	32	21,000	56.2	0.36	25.1	1.2	13.5	110
E-OABG	AS01-SB40	AS01-SS40-(0-1)	10/24/01	0	1	SS	NA	13	13	23	140	140	170	370	1,525	1,432	630	63,000	630	5.35E-05	24.9	84.7	29.8	43	972	70,900	416	0.17	79.4	1.2	29.7	1,400
E-OABG	AS01-SB41	AS01-SB41-(1-2)	10/24/01	1	2	SS	NA	11	11	29	220	220	250	350	1,745	1,975	570	57,000	570	1.01E-06	14.2	0.68	11.9	21	38.7	26,800	44.8	0.26	30.9	1.1	15.2	160
E-OABG	AS01-SB41	AS01-SS41-(0-1)	10/24/01	0	1	SS	NA	12	12	12	180	180	240	400	1,438	1,875	620	62,000	620	1.01E-05	16.3	0.81	14.3	44	43.7	29,500	51.8	0.17	63.3	1.2	22.2	192
W-OABG	AS01-SB46	AS01-SS46-0-1	07/20/04	0	1	SS	NA	2.9	12	12	78	88	150	NA	887	718	NA	NA	NA	NA	11.1	0.54	14.2	46.8	37.8	29,500	39.7	0.17	64.4	0.97	18.3	191
W-OABG	AS01-SB47	AS01-SS47-0-1	07/20/04	0	1	SS	NA	12	12	12	130	140	230	NA	659	1,094	NA	NA	NA	NA	11.9	0.25	15.7	41.8	46.6	31,300	43.6	0.96	60.2	2.9	21.3	217
W-OABG	AS01-SB48	AS01-SS48-0-1	07/20/04	0	1	SS	NA	850	610	3,600	64	81	150	NA	834	653	NA	NA	NA	NA	8.5	0.3	14.1	23.4	43.1	28,000	44.3	1	36.6	3.3	21.8	161
W-OABG	AS01-SB49	AS01-SS49-0-1	07/20/04	0	1	SS	NA	450	620	990	7,500	9,000	21,000	NA	14,760	72,300	NA	NA	NA	NA	12.4	0.069	19.7	34.6	43.5	32,300	44.9	0.36	54.5	0.54	21.8	181
E-OABG	AS01-SB50	AS01-SS50-0-1	07/21/04	0	1	SS	NA	11	14	14	24	24	45	NA	839	220	NA	NA	NA	2.63E-06	5.9	0.067	10.4	10.7	17.4	21,000	73	0.091	15.3	0.22	16.1	63.2
E-OABG	AS01-SB51	AS01-SS51-0-1	07/21/04	0	1	SS	NA	320	730	2,700	31	36	63	NA	886	280	NA	NA	NA	4.26E-05	8.5	13	23.5	23.9	123	31,100	223	0.26	37	1	26.5	845
E-OABG	AS01-SB52	AS01-SS52-0-1	07/21/04	0	1	SS	NA	300	560	6,400	46	55	91	NA	1026	426	NA	NA	NA	1.20E-04	8.6	4.5	42.7	20.3	253	57,100	591	2.1	50	2.4	22.4	1,170
E-OABG	AS01-SB53	AS01-SS53-0-1	07/21/04	0	1	SS	NA	1,800	1,800	36,000	34	40	75	NA	959	317	NA	NA	NA	1.34E-04	12.5	11	63.8	20	284	28,700	1,310	1	70.5	42.6	173	1,400
E-OABG	AS01-SB54	AS01-SS54-0-1	07/21/04	0	1	SS	NA	13	13	13	99	120	240	NA	954	972	NA	NA	NA	1.83E-05	12.8	0.3	17.1	37.1	44.1	32,400	47.4	0.3	56.6	0.45	25.4	176
W-OABG	AS01-SB56	AS01-SS56-0-1	07/21/04	0	1	SS	NA	NA	NA	NA	87	100	160	NA	960	826	NA	NA	NA	1.64E-05	11.8	0.4	15.6	42.8	41	31,600	38	0.25	59.7	1.2	21.9	200
W-OABG	AS01-SB57	AS01-SS57-0-1	07/21/04	0	1	SS	NA	NA	NA	NA	8,100	12,000	16,000	NA	63,100	82,500	NA	NA	NA	2.65E-05	11.2	5.2	59.5	15.8	517	30,400	939	0.44	45.5	5.5	58.3	841
E-OABG	AS01-SB58	AS01-SS58-0-1	07/21/04	0	1	SS	NA	NA	NA	NA	70	88	170	NA	843	709	NA	NA	NA	4.37E-05	11.2	0.46	14	39.7	39.8	28,700	43.7	0.23	57.4	0.24	22.1	180
E-OABG	AS01-SB59	AS01-SS59-0-1	07/21/04	0	1	SS	NA	NA	NA	NA	99	110	200	NA	976	865	NA	NA	NA	1.19E-05	12.7	0.37	16.4	42	44.1	32,400	45.3	0.24	62.9	0.25	24.9	181
E-OABG	AS01-SB71	AS01-SB71-1_5-2	09/23/04	1.5	2	SS	NA	14	26	13	440	440	51	440	1665	1639	1,500	2,500	140	2.16E-06	7	0.44	14.2	13.4	22.5	23,600	39.2	0.27	20.8	0.69	14.2	78.9
E-OABG	AS01-SB71	AS01-SS71-0-0_5	09/23/04	0	1	SS	NA	15	15	15	500	500	500	500	2,050	2,250	500	2,500	82	5.27E-06	9.5	1.8	15.1	27	35.6	28,700	61.5	0.23	42.8	0.7	23.4	179
E-OABG	AS01-SB72	AS01-SB72-4_5-5	09/23/04	4.5	5	SB	NA	2,800	11,000	77,000	470	470	470	470	2,115	2,115	75,000	30,000	1,800	1.85E-04	3.9	143	38.1	20.2	436	29,800	810	22.7	38.7	13.3	14.3	2,060
E-OABG	AS01-SB72	AS01-SS72-0-0_5	09/23/04	0	1	SS	NA	1,600	420	4,400	450	450	450	450	2,025	2,025	530,000	500	7,300	3.48E-04	7.2	373	319	27.7	248	54,200	814	56.3	56.0	12.3	17.8	2,060
E-OABG	AS01-SB73	AS01-SB73-1_5-2	09/23/04	1.5	2	SS	NA	12,000	12,000	170,000	400	400	400	400	1,800	1,800	76	2,500	500	2.09E-06	7.1	0.35	12.6	15	21.8	27,700	20.5	0.17	22.5	0.38	16.5	79.2
E-OABG	AS01-SB73	AS01-SS73-0-0_5	09/23/04	0	1	SS	NA	1,300	1,300	22,000	390	390	390	390	1,755	1,755	120	2,500	500	2.40E-05	8.7	2.1	37.6	16.3	172	40,700	111	0.42	37	41.2	30.2	311
E-OABG	AS01-SB74	AS01-SB74-4-4_5	09/23/04	4	5	SS	NA	15	3.3	57	460	460	460	460	2,070	2,070	100	2,500	500	6.82E-06	7	11.6	282	53.9	13,600	33,500	865	0.17	347	19.5	53.4	1,010
E-OABG	AS01-SB74	AS01-SS74-0-0_5	09/23/04	0	1	SS	NA	12	12	4.9	430	430	430	430	1,599	1,935	500	2,500	500	6.64E-06	7.5	0.7	31.1	18.5	94.9	31,600	66.8	0.34	29.3	0.97	19.5	182
W-OABG	AS01-TP02	AS01-TP02-0910	03/18/08	9	10	SB	NA	10	10	10	380	380	380	380	1,710	1,710	620	4,000	620	7.83E-08	6.6	0.43	13.4	6.7	16.4	32,900	9.7	0.11	19.2	1.1	16.3	64.9

Table 13
Outside Active Burning Grounds - Industrial Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
							COC CONCENTRATIONS																									
							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
INDUSTRIAL SRGs - Surface Soil (SS):							450	300	1,100	810	8,800	2,100	21,000	2,100	29,000	18,000	10,000	370	120	9.60E-05	16.0	17.4	42.7	52.3	253	35,600	785	1.61	78.4	42.6	173	1,170
INDUSTRIAL SRGs - Subsurface Soil (SB):							8,400	N/A	1,100	810	8,800	2,100	21,000	2,100	N/A	N/A	N/A	370	120	1.80E-04	16.0	130	N/A	20.9	11,000	33,000	830	39.0	N/A	N/A	N/A	N/A
W-OABG	AS01-TP03	AS01-TP03-0910	03/18/08	9	10	SB	NA	10	10	10	390	390	390	390	1,755	1,755	620	4,000	620	3.19E-07	5	0.23	10.7	11.6	14.3	24,200	11	0.11	14.5	1.2	16.2	49.2
W-OABG	AS01-TP04	AS01-TP04-0910	03/18/08	9	10	SB	NA	12	12	12	410	410	410	410	1,845	1,845	620	4,000	620	1.82E-07	4	0.2	8.8	7	9.2	19,700	8	0.12	13.2	1.2	11.8	43.7
W-OABG	AS01-TP05	AS01-DC01-0506	03/19/08	5	6	SB	NA	12	12	7,600	150	190	240	400	1,760	1,780	620	4,000	620	1.44E-04	6.2	8.2	27.2	20.3	704	27,500	178	5	46.1	104	57.2	1,440
W-OABG	AS01-TP05	AS01-TP05-0910	03/19/08	9	10	SB	NA	12	12	32	180	150	220	430	2,115	1,785	620	4,000	620	7.60E-05	6.7	6.6	19.3	17	278	28,800	153	2.7	40.6	69.6	70.8	420
W-OABG	AS01-TP06	AS01-TP06-0910	03/19/08	9	10	SB	NA	12	12	44	400	400	400	400	1,800	1,800	620	4,000	620	3.51E-07	4.6	0.27	13.2	3.7	9.4	26,900	6.7	0.12	11.6	0.19	13.2	51.1
W-OABG	AS01-TP07	AS01-DC03-0304	03/20/08	3	4	SS	NA	10	10	10	420	420	420	420	1,687	1,790	620	4,000	620	1.50E-05	7.9	1	27.7	13.4	563	33,400	99.4	0.043	27.9	1.3	19.3	926
W-OABG	AS01-TP07	AS01-TP07-0910	03/20/08	9	10	SB	NA	11	11	11	400	400	400	400	1,800	1,800	620	4,000	620	7.68E-08	5.6	0.23	12.5	6.8	17.2	25,900	9.9	0.063	14.1	1.2	15.6	67.9
W-OABG	AS01-TP08	AS01-TP08-0910	03/20/08	9	10	SB	NA	10	10	10	390	390	390	390	1,755	1,755	620	4,000	620	1.31E-07	4.3	0.23	9.8	8.5	11.4	20,700	9.1	0.12	12.7	0.17	13	44.5
W-OABG	AS01-TP09	AS01-DC02-0405	03/20/08	4	5	SS	NA	10	10	15	410	100	110	410	1,685	1,128	620	4,000	620	3.09E-05	7.2	8.3	36.8	13.2	69.3	23,600	179	0.12	203	1.6	994	721
W-OABG	AS01-TP09	AS01-TP09-0910	03/20/08	9	10	SB	NA	11	11	22	380	380	380	380	1,710	1,710	620	4,000	620	3.09E-07	4.9	0.2	11.5	13.1	16.9	24,700	12.2	0.11	17	1.2	18.8	62.2
W-OABG	AS01-TP10	AS01-TP10-0910	03/24/08	9	10	SB	NA	12	12	85	430	430	430	430	1,935	1,935	NA	NA	NA	NA	5	0.27	11.6	12.3	15.8	26,400	11.7	0.13	16.4	1.3	17.4	59.7
W-OABG	AS01-TP11	AS01-TP11-0910	03/24/08	9	10	SB	NA	16	16	24	490	490	490	490	2,080	2,080	620	4,000	620	NA	7.1	0.33	10.1	14.3	28.5	22,100	31.3	0.081	24.3	1.5	12.5	106
W-OABG	AS01-TP12	AS01-TP12-0809	03/25/08	8	9	SB	NA	12	12	150	480	480	480	480	2,160	2,160	NA	NA	NA	NA	5.9	0.29	10.9	10.1	15.8	26,700	11.9	0.049	15.7	1.4	17.5	61.4
W-OABG	AS01-TP13	AS01-TP13-0910	03/25/08	9	10	SB	NA	12	12	6,900	470	470	470	470	2,115	2,115	620	4,000	620	NA	4.7	0.29	10	10.4	11.5	20,600	10.1	0.14	17.3	1.4	13.3	51.5
W-OABG	AS01-TP14	AS01-DC04-0304	03/25/08	3	4	SS	NA	13	13	26,000	490	490	490	490	2,205	2,205	620	4,000	620	NA	5.1	0.31	9.4	11.6	20.6	19,600	14.5	0.062	18.9	0.18	13	61.6
W-OABG	AS01-TP14	AS01-TP14-0910	03/25/08	9	10	SB	NA	15	15	92,000	520	520	520	520	2,090	2,190	620	4,000	620	NA	9.2	0.6	14.4	19.1	42.3	25,700	36.5	0.71	29.7	0.31	16.1	125
W-OABG	AS01-TP15	AS01-TP15-0910	03/25/08	9	10	SB	NA	13	13	11,000	470	470	470	470	2,115	2,115	NA	NA	NA	NA	4.6	0.26	10.2	10.1	11.2	21,800	10	0.14	16.8	1.4	13.6	53.9
C-OABG	AS01-TP16	AS01-TP16-0809	03/25/08	8	9	SB	NA	16	16	62	500	500	500	500	2,050	2,000	620	4,000	620	8.28E-06	11.2	0.74	14.7	26.2	46.3	32,100	42.3	0.35	41.1	0.27	19.2	161
C-OABG	AS01-TP17	AS01-TP17-0809	03/25/08	8	9	SB	NA	14	14	14	470	470	470	470	1,885	1,990	620	4,000	620	4.70E-05	10.1	0.79	13.8	22.9	38.7	29,800	34.9	0.14	37	0.25	17.8	136
C-OABG	AS01-TP18	AS01-TP18-0910	03/26/08	9	10	SB	NA	10	10	10	380	380	380	380	1,710	1,710	620	4,000	620	NA	4.6	0.24	9.5	9.1	10.9	20,700	9.3	0.12	12.2	1.1	12.9	41.3
C-OABG	AS01-TP19	AS01-TP19-0910	03/26/08	9	10	SB	NA	10	10	6	390	390	390	390	1,755	1,755	NA	NA	NA	NA	3.8	0.21	7.7	8.5	10	17,600	8.3	0.12	10.4	1.2	11.1	35.3
C-OABG	AS01-TP20	AS01-TP20-0910	03/26/08	9	10	SB	NA	10	10	10	390	390	390	390	1,755	1,755	620	4,000	620	NA	3.8	0.21	8	8	10.1	19,300	8.3	0.12	11.6	1.2	12	41
C-OABG	AS01-TP21	AS01-TP21-0910	03/26/08	9	10	SB	NA	10	10	7	380	380	380	380	1,710	1,710	620	4,000	620	NA	3.7	0.19	8.2	7.8	10.3	17,200	10.1	0.12	11.3	1.2	11.2	37.1
C-OABG	AS01-TP22	AS01-TP22-0910	03/26/08	9	10	SB	NA	10	10	30	380	380	380	380	1,710	1,710	620	4,000	620	8.60E-08	4.7	0.26	9.1	8.9	9.7	21,400	8.6	0.12	13.3	1.2	12.3	47
E-OABG	AS01-TP23	AS01-DC12-0102	03/31/08	1	2	SS	NA	11	11	11	400	150	400	400	1,800	1,680	620	4,000	620	NA	5.9	0.45	10.4	9.6	22.4	19,300	93.7	0.17	16.2	0.67	15.9	81.5
E-OABG	AS01-TP23	AS01-TP23-0910	03/31/08	9	10	SB	NA	10	10	3	390	390	390	390	1,755	1,755	620	4,000	620	NA	4.4	0.12	9.2	8.4	11.8	21,300	11	0.054	12.5	1.2	13.1	41.5
E-OABG	AS01-TP24	AS01-TP24-0910	03/27/08	9	10	SB	NA	10	10	11	380	380	380	380	1,710	1,710	620	4,000	620	4.04E-08	4.4	0.21	9.3	9.2	12.8	21,400	9.3	0.12	12.4	1.2	13.5	42.4
E-OABG	AS01-TP25	AS01-DC13-0304	04/01/08	3	4	SS	NA	13	13	5	400	400	400	400	1,800	1,800	620	4,000	620	4.06E-07	8.2	2	31.7	11.3	29.9	25,800	45.8	0.31	94.1	0.91	20.1	253
E-OABG	AS01-TP25	AS01-TP25-0910	04/01/08	9	10	SB	NA	10	3	17	390	390	390	390	1,755	1,755	620	4,000	620	3.88E-08	5.3	0.26	11.2	9.3	13.8	24,500	29.1	0.12	13.7	1.2	15	48.4
E-OABG	AS01-TP26	AS01-TP26-0910	03/31/08	9	10	SB	NA	11	31	29	400	400	400	400	1,800	1,800	620	4,000	620	NA	3.9	0.22	8.6	8.8	10	18,600	7.5	0.06	14.3	1.2	10.8	43.5
E-OABG	AS01-TP27	AS01-DC10-0405	03/28/08	4	5	SS	NA	10	22	90	400	400	400	400	1,800	1,800	NA	NA	NA	NA	6.3	1.4	15.1	12.8	44.8	23,500	166	0.45	31.8	2.3	15.2	247
E-OABG	AS01-TP27	AS01-TP27-0910	03/28/08	9	10	SB	NA	10	26	62	360	360	360	360	1,620	1,620	NA	NA	NA	NA	5	1.9	11.3	10.2	15.1	23,100	10.9	0.046	17.5	0.72	13.7	51.4
E-OABG	AS01-TP28	AS01-DC09-0304	03/28/08	3	4	SS	NA	1,300	1,100	26,000	400	400	400	400	1,800	1,800	NA	NA	NA	NA	6.3	7.4	39.3	17.8	598	24,900	671	1.5	55.2	54.9	26	1,550
E-OABG	AS01-TP28	AS01-TP28-0910	03/28/08	9	10	SB	NA	10	20	12,000	400	400	400	400	1,800	1,800	620	4,000	620	NA	4.6	0.35	10.5	7.7	12.5	25,000	9.5	0.12	13.4	1.2	15.3	51.8
E-OABG	AS01-TP29	AS01-DC08-0304	03/28/08	3	4	SS	NA	10,000	10,000	70,000	380	380	380	380	1,710	1,710	NA	NA	NA	1.16E-06	6	1	12.1	10.3	23.9	25,700	25.2	4.9	19.3	4.4	16.6	285
E-OABG	AS01-TP29	AS01-TP29-0910	03/28/08	9	10	SB	NA	38,000	38,000	460,000	390	390	390	390	1655	1530	NA	NA	NA	NA	4.7	0.18	9.8	5.5	12.2	23,000	10.4	0.11	11.6	1.2	13	50.2
E-OABG	AS01-TP30	AS01-DC05-0203	03/27/08	2	3	SS	NA	13	13	11	420	420	420	420	1,740	1,674	NA	NA	NA	NA	9.4	8.4	77.7	25.5	779	30,900	197	2	75.9	4.6	19.3	840
E-OABG	AS01-TP30	AS01-TP30-0910	03/27/08	9	10	SB	NA	13	13	3	110	96	130	430	2,005	1,461	620	4,000	620	NA	6.1	0.71	9.3	22.7	489	19,800	30.4	0.072	25.9	0.38	10.8	142
W-OABG	AS01-TP32	AS01-TP32-0910	03/24/08	9	10	SB	NA	15	15	31	150	120	130	500	2,300	1,710	NA	NA	NA	NA	10.4	0.49	14.3	20.9	54.7	28,700	53.7	0.18	36.7	0.39	17.3	155
W-OABG	AS01-TP33	AS01-TP33-0607	03/25/08	6	7	SB	NA	13	13	170	490	490	490	490	2,205	2,205	NA	NA	NA	NA	4.9	0.27	9.1	9.9	16.1	20,600	12.1	0.099	17	1.5	12.3	55
C-OABG	AS01-TP34	AS01-TP34-0910	03/26/08	9	10	SB	NA	10	10	9	380	380	380	380	1,710	1,710	NA	NA	NA	NA	3.4	0.17	7.4	7	8.8	16,000	7.1	0.12	8.8	1.2	10	31.3
E-OABG	AS01-TP35	AS01-DC11-0203	03/31/08	2	3	SS	NA	11	11	11	390	390	390	390	1,755	1,755	620	4,000	620	NA	4.6	0.43	10.7	9.9	18.1	22,100	47.3	0.12	15.1	1.2	16.2	65.5
E-OABG	AS01-TP35	AS01-TP35-0910	03/31/08	9	10	SB	NA	10	10	12	390	390	390	390	1,755	1,755	NA	NA	NA	NA	4.7	1.9	10.1	11	12	22,600	10.1	0.04	14	0.57	14.2	48.3
E-OABG	AS01-TP36	AS01-DC07-0304	03/27/08	3	4	SS	NA	10	2	230,000	340	340	340	340	1,530	1,530	620	4,000	620	NA	4.4	0.35	7.7	11	15.3	16,400	14.3	0.052	15.5	0.17	10.8	49.2
E-OABG	AS01-TP36	AS01-TP36-0910	03/27/08	9	10	SB	NA	14	4	730,000	480	480	480	480	2,160	2,160	620	4,000	620	6.44E-06	4.1	0.28	8.2	8.2	13	17,800	12.1	0.15	13.7	0.25	10.5	49.3
E-OABG	AS01-TP37	AS01-DC06-0203	03/27/08	2	3	SS	NA	14	14	16	97	430	110	430	1,905	1,482	NA	NA	NA	NA	10	0.91	15.7	19.9	52.6	25,100	58.7	0.68	31.8	4	16.4	197
E-OABG	AS01-TP37	AS01-TP37-0910	03/27/08	9	10	SB	NA	12	12	19	420	420	420	420	1,890	1,890	NA	NA	NA	NA	7.6	0.73	10	12.7	32.3	19,800	62.4	0.25	21.4	0.7	12.6	196
E-OABG	AS01-TP38	AS01-TP38-0910	03/27/08	9	10	SB	NA	13	13	9	450	450	450	450	2,025	2,025	620	4,000	620	NA	5.2	0.59	7.7	37.8	43.5	21,100	20.5	0.055	30.4	1.4	9.5	114
E-OABG	B1-003	HCS-B1-3-1	07/17/92	1	2	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.5	3.4	46.9	14.5	79.9	28,400	173	0.28	25.7	1.1	17.9	383
E-OABG	B1-003	HCS-B1-3-S	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.4	22.9	51.4	28.4	309	27,200	793	0.56	44.2	5.8	34.7	1,290
E-OABG	B1-004	HCS-B1-4-S	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.4	57.1	100	39.8	780	122,000	12,100	1	107	12.6	18.1	3,860
E-OABG	B1-011	HCS-B1-11-2	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.8	46.8	99.8	26.8	1,390	81,100	993	4.6	102	104	97.5	3,350
E-OABG	B1-011	HCS-B1-11-S	07/17/92	1	2	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.2	154	103	31.6	855	45,700	6,680	2.5	74.1	24.8	30.3	2,160
E-OABG	B1-12S/12	HCS-B1-12-1	11/16/94	0	1	SS	NA	NA	NA	NA	380	380	380	380	1,710	1,710	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	B1-12S/12	HCS-B1-12-S	11/16/94	0	1	SS	NA	NA	NA	NA	68	500	92	500	2,020	1,617	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	B1-13S/13	HCS-B1-13-1	11/16/94	0	1	SS	NA	NA	NA	NA	88	70	82	370	1544	737	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	B1-13S/13	HCS-B1-13-S	11/16/94	0	1	SS	NA	NA	NA	NA	520	520	520	520	2,340	2,340	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	B1-C	HCS-B1-C	07/17/92	0	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.21E-04	7.3	3.3	10	5.5	81.9	10,500	4,990	2.1	11.4	8.9	5.6	291
E-OABG	B1-CS	HCS-B1-CS	06/20/94	1	2	SS	NA	NA	NA	NA	380	380	380	380	1,710	1,710	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	B2-003	HCS-B2-3-4	07/17/92	3	4	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.7	0.74	31.5	21.1	136	28,500	68.6	0.32	55.1	6.5	108	408
W-OABG	B2-003	HCS-B2-3-S	07/17/92	2	3	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.5	5.3	55.1	24.6	579	31,900	1,630	1.2	49.7	78.8	33.4	679
W-OABG	B2-004	HCS-B2-4-4	07/17/92	3	4	SS	NA	NA	NA	NA	1,700	1,400	1,500	230	7,136	11,530	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	B2-005	HCS-B2-5-3	07/17/92	2	3	SS	NA	NA	NA	NA	700	690	730	390	2,883	5,565	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	B2-006	HCS-B2-6-3	07/17/92	2	3	SS	NA	NA	NA	NA	95	83	100	490	1,918	1,127	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	B2-007	HCS-B2-7-3	07/17/92	2	3	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.9	0.71	15.3	18.9	54.5	30,400	74.6	0.4	38	2.1	14.6	163
W-OABG	B2-007	HCS-B2-7-S	07/17/92	1	2	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.3	1.9	29.8	25.6	2,150	25,100	272	2.7	40.3	121	82.7	636
W-OABG	B2-010	HCS-B2-10	07/17/92	5	6	SB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11	37.5	110	30.6	1,970	31,300	472	16.8	185	106	100	4,230
W-OABG	B2-C	HCS-B2-C	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.88E-04	12.9	6.8	34	25.5	348	31,900	200	3.2	66.4	64.5	75.8	849
E-OABG	BG-003	HCS-BG-3	07/13/92	3	4	SS	6	NA	6	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-015	HCS-BG-15	07/13/92	3	4	SS	6	NA	6	26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-023/023S/083	HCS-BG-23S	06/21/94	0	1	SS	11	NA	11	14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-084/084S/106	HCS-BG-106	07/13/92	11	12	SB	750	NA	750	2,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 13
Outside Active Burning Grounds - Industrial Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATIONS																									
							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
						INDUSTRIAL SRGs - Surface Soil (SS):	450	300	1,100	810	8,800	2,100	21,000	2,100	29,000	18,000	10,000	370	120	9.60E-05	16.0	17.4	42.7	52.3	253	35,600	785	1.61	78.4	42.6	173	1,170
						INDUSTRIAL SRGs - Subsurface Soil (SB):	8,400	N/A	1,100	810	8,800	2,100	21,000	2,100	N/A	N/A	N/A	370	120	1.80E-04	16.0	130	N/A	20.9	11,000	33,000	830	39.0	N/A	N/A	N/A	N/A
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
E-OABG	BG-084/084S/106	HCS-BG-84	07/13/92	3	4	SS	6	NA	6	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-084/084S/106	HCS-BG-84S	06/20/94	0	1	SS	11	NA	11	110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-098/098S	HCS-BG-98S	11/16/94	0	1	SS	1,800	NA	1,800	27,000	110	71	99	460	1,940	923	NA	NA	NA	NA	15.8	3.5	23.6	31.2	75.5	38,600	53.3	0.46	50.8	3.3	26.2	206
W-OABG	BG-099	HCS-BG-99	07/13/92	2	3	SS	6	NA	6	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-099	HCS-BG-99R	07/13/92	2	3	SS	6	NA	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-102/102S	HCS-BG-102	07/13/92	1	2	SS	260	NA	1,400	25,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-102/102S	HCS-BG-102S	11/16/94	0	1	SS	71	NA	29	890	100	80	120	450	1,847	980	NA	NA	NA	NA	11.4	2.9	13.1	38.6	37.3	32,600	37.1	0.14	58.8	1.5	20.1	210
E-OABG	BG-110/110S	HCS-BG-110	07/13/92	2	3	SS	27,000	NA	820	34,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-110/110S	HCS-BG-110S	11/16/94	0	1	SS	16,000	NA	1,600	26,000	85	61	84	440	1800	805	NA	NA	NA	NA	10.2	2.3	11.9	55.2	33.7	28,700	38.5	0.1	76.1	1.1	18.8	233
W-OABG	BG-112	HCS-BG-112	07/13/92	2	3	SS	33	NA	7	56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-112	HCS-BG-112R	07/13/92	2	3	SS	7	NA	7	14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-113	HCS-BG-113	07/13/92	2	3	SS	880	NA	880	94,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-113	HCS-BG-113S	11/15/94	0	1	SS	1,800	NA	1,800	8,000	100	85	170	57	1,900	1,331	NA	NA	NA	NA	14.8	3.1	19.9	37.2	49.8	35,200	57.6	0.48	53.3	2.7	24.5	192
W-OABG	BG-134	HCS-BG-134	11/16/94	2	3	SS	2,300	NA	1,500	230,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-135	HCS-BG-135	11/16/94	2	3	SS	11	NA	2	73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-136	HCS-BG-136	11/16/94	2	3	SS	11	NA	56	730	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-137	HCS-BG-137	11/16/94	2	3	SS	12	NA	12	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-138	HCS-BG-138	11/16/94	2	3	SS	1,300	NA	1,700	140,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-139	HCS-BG-139	11/15/94	2	3	SS	1,800	NA	1,800	4,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-140	HCS-BG-140	11/15/94	2	3	SS	2	NA	12	41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-141	HCS-BG-141	11/16/94	2	3	SS	12	NA	12	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-142	HCS-BG-142	11/16/94	2	3	SS	12	NA	12	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-143	HCS-BG-143	11/16/94	2	3	SS	12	NA	12	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-144	HCS-BG-144	11/16/94	2	3	SS	12	NA	12	28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-145	HCS-BG-145	11/16/94	2	3	SS	1	NA	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-146	HCS-BG-146	11/16/94	2	3	SS	1,600	NA	2,200	20,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-147	HCS-BG-147	11/16/94	2	3	SS	840	NA	480	53,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-148	HCS-BG-148	11/16/94	2	3	SS	24,000	NA	160	64,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-149	HCS-BG-149	11/16/94	2	3	SS	1,500	NA	1,500	6,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-150	HCS-BG-150	11/15/94	2	3	SS	1,500	NA	1,500	17,000	77	74	360	360	1,580	1,301	NA	NA	NA	NA	8.3	2.1	8.8	20.2	31.3	25,200	30.4	0.22	31.3	2.1	17.3	124
W-OABG	BG-151	HCS-BG-151	03/04/95	2	3	SS	12	NA	1	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-154	HCS-BG-154	10/27/98	2	3	SS	11	NA	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-155	HCS-BG-155	10/27/98	2	3	SS	11	NA	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-156	HCS-BG-156	10/27/98	2	3	SS	52	NA	11	900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-157	HCS-BG-157	10/27/98	2	3	SS	11	NA	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-158	HCS-BG-158	10/27/98	2	3	SS	7,100	NA	11	46,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-159/160	HCS-BG-159	10/27/98	2	3	SS	11	NA	11	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-159/160	HCS-BG-160	10/27/98	4	6	SB	11	NA	11	57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-163/164	HCS-BG-163	10/27/98	2	3	SS	11	NA	11	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-163/164	HCS-BG-164	10/27/98	4	6	SB	11	NA	11	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-166	HCS-BG-166	10/27/98	2	3	SS	3	NA	11	92,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-167/168	HCS-BG-167	10/27/98	2	3	SS	11	NA	11	51,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-167/168	HCS-BG-168	10/27/98	4	6	SB	3	NA	13	720	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-169	HCS-BG-169	10/27/98	2	3	SS	11	NA	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-170	HCS-BG-170	10/27/98	2	3	SS	11	NA	11	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-172	HCS-BG-172	10/27/98	2	3	SS	11	NA	41	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-173	HCS-BG-173	10/27/98	2	3	SS	11	NA	4	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-174	HCS-BG-174	10/27/98	2	3	SS	6	NA	11	360,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-175/176	HCS-BG-175	10/27/98	2	3	SS	11	NA	11	99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-175/176	HCS-BG-176	10/27/98	4	6	SB	11	NA	11	530	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-177/178	HCS-BG-177	10/27/98	2	3	SS	11	NA	11	42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-177/178	HCS-BG-178	10/27/98	4	6	SB	11	NA	11	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

1 - Red shading indicates maximum ratios >5; orange shading indicates maximum ratios between 1 and 5;

green shading indicates low magnitude (ratio ≤1.5) metal SRG exceedances

Gray shaded concentrations indicate detections; NA - Not Analyzed

Notes:
µg/kg = microgram per kilogram
COC = constituent of concern
ft = foot
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification
mg/kg = miligram per kilogram
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
SRG = site remediation goal
VOC = volatile organic compound

Table 13
Outside Active Burning Grounds - Industrial Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATION-to-SRG RATIOS: VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)														
						INDUSTRIAL SRGs - Surface Soil (SS): INDUSTRIAL SRGs - Subsurface Soil (SB):																													
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc	Maximum Ratio[1]	COC	Other COCs with Ratios > 5
W-OABG	22C-1	22C-1-T	10/26/95	0	1	SS															0.41	0.16	0.45		0.10	0.79	0.10	0.26	0.27	0.18	0.11	0.11	0.79		
W-OABG	22C-2	22C-2-T	10/26/95	0	1	SS																	0.16			0.19	0.01					0.02	0.19		
W-OABG	22D-1	22D-1-D	10/26/95	2	4	SS															0.41	0.06	0.32	0.25	0.09	0.76	0.03	0.34	0.22		0.12	0.08	0.76		
W-OABG	22D-1	22D-1-T	10/26/95	0	1	SS															0.27	0.11	0.52		0.13	0.35	0.10	3.29	0.11	0.27	0.09	0.22	3.29	Mercury	
W-OABG	AOCM-1	AOCM-1-T	10/26/01	0	1	SS					0.02		0.01		0.06	0.07					1.04		0.37	0.82	0.18	0.88	0.07	0.21	0.78	0.06	0.21	0.19	1.04	Arsenic	
W-OABG	AOCM-2	AOCM-2-T	10/26/01	0	1	SS					0.01		0.00		0.06	0.05					0.60		0.30	0.46	0.13	0.58	0.06	0.19	0.49	0.05	0.24	0.12	0.60		
E-OABG	AS01-SB21	AS01-SS21-(0-1)	10/25/01	0	1	SS				101	0.01	0.03	0.00		0.06	0.06					0.82	0.71	1.01	0.45	2.08	0.95	1.43	2.92	0.60	1.65	0.26	0.88	101	TCE	
E-OABG	AS01-SB22	AS01-SS22-(0-1)	10/25/01	0	1	SS				80.2	0.01	0.04	0.01		0.05	0.06					1.21	0.37	5.25	0.66	4.27	1.63	0.43	1.55	3.06	1.43	1.92	1.16	80.2	TCE	Chromium
W-OABG	AS01-SB23	AS01-SS23-(0-1)	10/26/01	0	1	SS					0.01		0.01		0.06	0.06					0.64		0.53	0.36	0.23	0.69	0.06	0.15	0.37	0.28	0.14	0.20	0.69		
W-OABG	AS01-SB24	AS01-SB24-(1-2)	10/24/01	1	2	SS									0.04						0.74		0.29	0.46	0.20	0.59	0.08	0.16	0.43		0.07	0.13	0.74		
W-OABG	AS01-SB24	AS01-SS24-(0-1)	10/24/01	0	1	SS					0.09	0.32	0.04	0.02	0.13	0.35					0.90	0.04	0.27	1.11	0.16	0.72	0.05	0.18	1.01	0.04	0.10	0.20	1.11	Cobalt	
W-OABG	AS01-SB25	AS01-SB25-(1-2)	10/24/01	1	2	SS					6.59	26.2	3.10	1.00	8.28	27.3					0.46		0.23	0.31	0.11	0.47	0.03	0.28	0.32	0.04	0.06	0.11	27.3	HMW PAH	Benzo(a)anthracene, Benzo(a)pyrene, LMW PAH
W-OABG	AS01-SB25	AS01-SS25-(0-1)	10/24/01	0	1	SS					0.08	0.36	0.05		0.12	0.34					1.14	0.05	0.36	1.06	0.19	0.91	0.06	0.17	0.99	0.09	0.13	0.21	1.14	Arsenic	
W-OABG	AS01-SB26	AS01-SB26-(1-2)	10/23/01	1	2	SS				30.9	0.01	0.06	0.01		0.06	0.07					1.29		0.49	0.54	0.26	1.03	0.09	0.43	0.54		0.12	0.18	30.9	TCE	
W-OABG	AS01-SB26	AS01-SS26-(0-1)	10/23/01	0	1	SS				0.15	0.02	0.08	0.01	0.20	0.06	0.12					1.15		0.42	0.84	0.22	0.97	0.07	0.11	1.07		0.15	0.18	1.15	Arsenic	
W-OABG	AS01-SB27	AS01-SB27-(1-2)	10/23/01	1	2	SS					0.02	0.09	0.02		0.05	0.11					0.92		0.39	0.39	0.15	0.88	0.05	0.22	0.37		0.11	0.11	0.92		
W-OABG	AS01-SB27	AS01-SS27-(0-1)	10/23/01	0	1	SS				0.02	0.02	0.08	0.01		0.06	0.10					0.69		0.27	0.74	0.16	0.62	0.06	0.09	0.71		0.09	0.14	0.74		
W-OABG	AS01-SB28	AS01-SS28-(0-1)	10/26/01	0	1	SS				0.01	0.01		0.01		0.06	0.05					0.81		0.30	0.80	0.15	0.75	0.05	0.43	0.76		0.11	0.15	0.81		
E-OABG	AS01-SB29	AS01-SS29-(0-1)	10/26/01	0	1	SS				0.02	0.01		0.00		0.06	0.07					0.90		0.31	0.76	0.14	0.75	0.06	0.10	0.69		0.13	0.14	0.90		
E-OABG	AS01-SB30	AS01-SB30-(1-2)	10/24/01	1	2	SS			0.01	16.0	0.04	0.16	0.02		0.08	0.18				0.13	1.94	0.71	2.62	0.77	1.31	3.43	3.24	2.80	0.81	1.01	0.15	0.85	16.0	TCE	
E-OABG	AS01-SB30	AS01-SS30-(0-1)	10/24/01	0	1	SS				0.03	0.03	0.11	0.01		0.06	0.13				0.04	0.66		0.22	0.98	0.14	0.53	0.05		0.96		0.08	0.18	0.98		
W-OABG	AS01-SB33	AS01-SS33-(0-1)	10/26/01	0	1	SS					0.03		0.01		0.07	0.11				0.14	1.12		0.36	0.80	0.18	0.94	0.05	0.11	0.74	0.04	0.12	0.16	1.12	Arsenic	
W-OABG	AS01-SB34	AS01-SB34-(1-2)	10/25/01	1	2	SS				0.03	0.02	0.09	0.01		0.05	0.12				0.76	0.94	0.72	0.87	0.78	3.95	1.15	0.27	0.35	0.94	2.24	0.46	0.92	3.95	Copper	
W-OABG	AS01-SB34	AS01-SS34-(0-1)	10/25/01	0	1	SS				0.01	0.04	0.16	0.02		0.06	0.17					1.03	0.05	0.35	1.15	0.24	0.91	0.06	0.25	1.01	0.23	0.12	0.24	1.15	Cobalt	
W-OABG	AS01-SB35	AS01-SS35-(0-1)	10/26/01	0	1	SS					0.02		0.01		0.05	0.08				0.06	0.86		0.30	0.75	0.15	0.78	0.06	0.11	0.70	0.04	0.11	0.16	0.86		
W-OABG	AS01-SB36	AS01-SB36-(1-2)	10/25/01	1	2	SS					0.01	0.03	0.00		0.05	0.05				0.15	0.63	0.07	0.29	0.30	0.18	0.69	0.06	0.09	0.29	0.14	0.08	0.19	0.69		
W-OABG	AS01-SB36	AS01-SS36-(0-1)	10/25/01	0	1	SS					0.01	0.05	0.01		0.05	0.07				0.18	1.12		0.39	0.78	0.18	0.98	0.06	0.11	0.72		0.13	0.17	1.12	Arsenic	
W-OABG	AS01-SB37	AS01-SS37-(0-1)	10/26/01	0	1	SS					0.02		0.01		0.06	0.08				0.24	0.81	0.04	0.48	0.56	0.64	0.70	0.13	0.17	0.60	0.07	0.19	0.31	0.81		
W-OABG	AS01-SB38	AS01-SB38-(1-2)	10/26/01	1	2	SS					0.02	0.08	0.01		0.05	0.08				0.01	0.67		0.33	0.29	0.09	0.79	0.04		0.24		0.11	0.07	0.79		
W-OABG	AS01-SB38	AS01-SS38-(0-1)	10/26/01	0	1	SS					0.02	0.07	0.01		0.06	0.08				0.19	0.57		0.32	0.41	0.11	0.58	0.05		0.41		0.13	0.09	0.58		
W-OABG	AS01-SB39	AS01-SB39-(1-2)	10/23/01	1	2	SS				19.8	0.04	0.15	0.02		0.07	0.17					1.34	0.05	0.56	0.54	0.28	0.96	0.11	0.49	0.55		0.12	0.19	19.8	TCE	
W-OABG	AS01-SB39	AS01-SS39-(0-1)	10/23/01	0	1	SS				0.22	0.01	0.05	0.01		0.05	0.07					0.82		0.29	0.73	0.15	0.65	0.06		0.70		0.09	0.14	0.82		
E-OABG	AS01-SB40	AS01-SB40-(1-2)	10/24/01	1	2	SS			0.01	0.02	0.03	0.15	0.02		0.08	0.18				0.06	0.63		0.31	0.37	0.13	0.59	0.07	0.22	0.32		0.08	0.09	0.63		
E-OABG	AS01-SB40	AS01-SS40-(0-1)	10/24/01	0	1	SS				0.03	0.02	0.07	0.01		0.05	0.08				0.56	1.56	4.87	0.70	0.82	3.84	1.99	0.53	0.11	1.01		0.17	1.20	4.87	Cadmium	
E-OABG	AS01-SB41	AS01-SB41-(1-2)	10/24/01	1	2	SS				0.04	0.03	0.10	0.01		0.06	0.11				0.01	0.89		0.28	0.40	0.15	0.75	0.06	0.16	0.39		0.09	0.14	0.89		
E-OABG	AS01-SB41	AS01-SS41-(0-1)	10/24/01	0	1	SS					0.02	0.09	0.01		0.05	0.10				0.11	1.02	0.05	0.33	0.84	0.17	0.83	0.07	0.11	0.81		0.13	0.16	1.02	Arsenic	
W-OABG	AS01-SB46	AS01-SS46-0-1	07/20/04	0	1	SS		0.01			0.01	0.04	0.01		0.03	0.04					0.69		0.33	0.89	0.15	0.83	0.05	0.11	0.82		0.11	0.16	0.89		
W-OABG	AS01-SB47	AS01-SS47-0-1	07/20/04	0	1	SS					0.01	0.07	0.01		0.02	0.06					0.74		0.37	0.80	0.18	0.88	0.06	0.60	0.77	0.07	0.12	0.19	0.88		
W-OABG	AS01-SB48	AS01-SS48-0-1	07/20/04	0	1	SS		2.83		4.44	0.01	0.04	0.01		0.03	0.04					0.53		0.33	0.45	0.17	0.79	0.06	0.62	0.47	0.08	0.13	0.14	4.44	TCE	
W-OABG	AS01-SB49	AS01-SS49-0-1	07/20/04	0	1	SS		1.50		1.22	0.85	4.29	1.00		0.51	4.02					0.78		0.46	0.66	0.17	0.91	0.06	0.22	0.70		0.13	0.15	4.29	Benzo(a)pyrene	
E-OABG	AS01-SB50	AS01-SS50-0-1	07/21/04	0	1	SS		0.04			0.00	0.01	0.00		0.03	0.01				0.03	0.37		0.24	0.20	0.07	0.59	0.09	0.06	0.20		0.09	0.05	0.59		
E-OABG	AS01-SB51	AS01-SS51-0-1	07/21/04	0	1	SS		1.07	0.66	3.33	0.00	0.02	0.00		0.03	0.02				0.44	0.53	0.75	0.55	0.46	0.49	0.87	0.28	0.16	0.47		0.15	0.72	3.33	TCE	
E-OABG	AS01-SB52	AS01-SS52-0-1	07/21/04	0	1	SS		1.00	0.51	7.90	0.01	0.03	0.00		0.04	0.02				1.25	0.54	0.26	1.00	0.39	1.00	1.60	0.75	1.30	0.64	0.06	0.13	1.00	7.90	TCE	
E-OABG	AS01-SB53	AS01-SS53-0-1	07/21/04	0	1	SS				44.4	0.00	0.02	0.00		0.03	0.02				1.40	0.78	0.63	1.49	0.38	1.12	0.81	1.67	0.62	0.90	1.00	1.00	1.20	44.4	TCE	
E-OABG	AS01-SB54	AS01-SS54-0-1	07/21/04	0	1	SS					0.01	0.06	0.01		0.03	0.05				0.19	0.80		0.40	0.71	0.17	0.91	0.06	0.19	0.72		0.15	0.15	0.91		
W-OABG	AS01-SB56	AS01-SS56-0-1	07/21/04	0	1	SS					0.01	0.05	0.01		0.03	0.05				0.17	0.74		0.37	0.82	0.16	0.89	0.05	0.16	0.76		0.13	0.17	0.89		
W-OABG	AS01-SB57	AS01-SS57-0-1	07/21/04	0	1	SS					0.92	5.71	0.76		2.18	4.58				0.28	0.70	0.30	1.39	0.30	2.04	0.85	1.20	0.27	0.58	0.13	0.34	0.72	5.71	Benzo(a)pyrene	
E-OABG	AS01-SB58	AS01-SS58-0-1	07/21/04	0	1	SS					0.01	0.04	0.01		0.03	0.04				0.46	0.70		0.33	0.76	0.16	0.81	0.06	0.14	0.73		0.13	0.15	0.81		
E-OABG	AS01-SB59	AS01-SS59-0-1	07/21/04	0	1	SS					0.01	0.05	0.01		0.03	0.05				0.12	0.79		0.38	0.80	0.17	0.91	0.06	0.15	0.80		0.14	0.15	0.91		
E-OABG	AS01-SB71	AS01-SB71-1_5-2	09/23/04	1.5	2	SS			0.02	0.02			0.00		0.06	0.09	0.15		1.17	0.02	0.44	0.03	0.33	0.26	0.09	0.66	0.05	0.17	0.27	0.02	0.08	0.07	1.17	RDX	
E-OABG	AS01-SB71	AS01-SS71-0-0_5	09/23/04	0	1	SS									0.07		0.05		0.68	0.05	0.59	0.10	0.35	0.52	0.14	0.81	0.08	0.14	0.55	0.02	0.14	0.15	0.81		
E-OABG	AS01-SB72	AS01-SB72-4_5-5	09/23/04	4.5	5	SB			10.0	95.1								81.1	15.0	1.03	0.24	1.10		0.97	0.04	0.90	0.98	0.58					95.1	TCE	Tetrachloroethene, RDX, Nitroglycerin
E-OABG	AS01-SB72	AS01-SS72-0-0_5	09/23/04	0	1	SS		5.33	0.38	5.43							53.0	1.35	60.8	3.63	0.45	21.4	7.47	0.53	0.98	1.52	1.04	35.0	0.71	0.29	0.10	1.76	60.8	RDX	Methyl acetate, TCE, HMX, Cadmium, Chromium, Mercury
E-OABG	AS01-SB73	AS01-SB73-1_5-2	09/23/04	1.5	2	SS				210							0.01			0.02	0.44		0.30	0.29	0.09	0.78	0.03	0.11	0.29	0.01	0.10	0.07	210	TCE	
E-OABG	AS01-SB73	AS01-SS73-0-0_5	09/23/04	0	1	SS				27.2							0.01			0.25	0.54	0.12	0.88	0.31	0.68	1.14	0.14	0.26	0.47	0.97	0.17	0.27	27.2	TCE	
E-OABG	AS01-SB74	AS01-SB74-4-4_5	09/23/04	4	5	SS			0.00	0.07							0.01			0.07	0.44	0.67	6.60	1.03	53.8	0.94	1.10	0.11	4.43	0.46	0.31	0.86	53.8	Copper	Chromium
E-OABG	AS01-SB74	AS01-SS74-0-0_5	09/23/04	0	1	SS				0.01					0.06					0.07	0.47	0.04	0.73	0.35	0.38	0.89	0.09	0.21	0.37	0.02	0.11	0.16	0.89		
W-OABG	AS01-TP02	AS01-TP02-0910	03/18/08	9	10	SB														0.00	0.41	0.00		0.32	0.00	1.00	0.01						0.997		

Table 13
Outside Active Burning Grounds - Industrial Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

COC CONCENTRATION-to-SRG RATIOS

INDUSTRIAL SRGs - Surface Soil (SS):
INDUSTRIAL SRGs - Subsurface Soil (SB):

Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	VOCs (ug/kg): 1,2-Dichloroethene (tota	VOCs: Methyl acetate	VOCs: Tetrachloroethene	VOCs: Trichloroethene	SVOCs (ug/kg): Benzo(a)anthracene	SVOCs: Benzo(a)pyrene	SVOCs: Benzo(b)fluoranthene	SVOCs: Dibenz(a,h)anthracene	SVOCs: Total PAHs - LMW	SVOCs: Total PAHs - HMW	Explosives (ug/kg): HMX	Explosives: Nitroglycerin	Explosives: RDX	Dioxins/ Furans (mg/kg): TEQs	Metals (mg/kg): Arsenic	Metals: Cadmium	Metals: Chromium	Metals: Cobalt	Metals: Copper	Metals: Iron	Metals: Lead	Metals: Mercury	Metals: Nickel	Metals: Silver	Metals: Vanadium	Metals: Zinc	Maximum Ratio[1]	COC	Other COCs with Ratios > 5
W-OABG	AS01-TP03	AS01-TP03-0910	03/18/08	9	10	SB														0.00	0.31	0.00		0.56	0.00	0.73	0.01						0.73		
W-OABG	AS01-TP04	AS01-TP04-0910	03/18/08	9	10	SB														0.00	0.25	0.00		0.33	0.00	0.60	0.01						0.60		
W-OABG	AS01-TP05	AS01-DC01-0506	03/19/08	5	6	SB				9.38	0.02	0.09	0.01							0.80	0.39	0.06		0.97	0.06	0.83	0.21	0.13					9.38	TCE	
W-OABG	AS01-TP05	AS01-TP05-0910	03/19/08	9	10	SB				0.04	0.02	0.07	0.01							0.42	0.42	0.05		0.81	0.03	0.87	0.18	0.07					0.87		
W-OABG	AS01-TP06	AS01-TP06-0910	03/19/08	9	10	SB				0.05										0.00	0.29	0.00		0.18	0.00	0.82	0.01						0.82		
W-OABG	AS01-TP07	AS01-DC03-0304	03/20/08	3	4	SS									0.06	0.10				0.16	0.49	0.06	0.65	0.26	2.23	0.94	0.13	0.03	0.36	0.03	0.11	0.79	2.23	Copper	
W-OABG	AS01-TP07	AS01-TP07-0910	03/20/08	9	10	SB														0.00	0.35	0.00		0.33	0.00	0.78	0.01	0.00					0.78		
W-OABG	AS01-TP08	AS01-TP08-0910	03/20/08	9	10	SB														0.00	0.27	0.00		0.41	0.00	0.63	0.01						0.63		
W-OABG	AS01-TP09	AS01-DC02-0405	03/20/08	4	5	SS				0.02		0.05	0.01		0.06	0.06				0.32	0.45	0.48	0.86	0.25	0.27	0.66	0.23		2.59	0.04	5.75	0.62	5.75	Vanadium	
W-OABG	AS01-TP09	AS01-TP09-0910	03/20/08	9	10	SB				0.03										0.00	0.31	0.00		0.63	0.00	0.75	0.01						0.75		
W-OABG	AS01-TP10	AS01-TP10-0910	03/24/08	9	10	SB				0.10											0.31	0.00		0.59	0.00	0.80	0.01						0.80		
W-OABG	AS01-TP11	AS01-TP11-0910	03/24/08	9	10	SB				0.03											0.44	0.00		0.68	0.00	0.67	0.04						0.68		
W-OABG	AS01-TP12	AS01-TP12-0809	03/25/08	8	9	SB				0.19											0.37	0.00		0.48	0.00	0.81	0.01						0.81		
W-OABG	AS01-TP13	AS01-TP13-0910	03/25/08	9	10	SB				8.52											0.29	0.00		0.50	0.00	0.62	0.01						8.52	TCE	
W-OABG	AS01-TP14	AS01-DC04-0304	03/25/08	3	4	SS				32.1											0.32	0.02	0.22	0.22	0.08	0.55	0.02		0.24	0.00	0.08	0.05	32.1	TCE	
W-OABG	AS01-TP14	AS01-TP14-0910	03/25/08	9	10	SB				114											0.58	0.00		0.91	0.00	0.78	0.04	0.02					114	TCE	
W-OABG	AS01-TP15	AS01-TP15-0910	03/25/08	9	10	SB				13.6											0.29	0.00		0.48	0.00	0.66	0.01						13.6	TCE	
C-OABG	AS01-TP16	AS01-TP16-0809	03/25/08	8	9	SB				0.08										0.05	0.70	0.01		1.25	0.00	0.97	0.05	0.01					1.25	Cobalt	
C-OABG	AS01-TP17	AS01-TP17-0809	03/25/08	8	9	SB														0.26	0.63	0.01		1.10	0.00	0.90	0.04						1.10	Cobalt	
C-OABG	AS01-TP18	AS01-TP18-0910	03/26/08	9	10	SB															0.29	0.00		0.44	0.00	0.63	0.01						0.63		
C-OABG	AS01-TP19	AS01-TP19-0910	03/26/08	9	10	SB				0.01											0.24	0.00		0.41	0.00	0.53	0.01						0.53		
C-OABG	AS01-TP20	AS01-TP20-0910	03/26/08	9	10	SB															0.24	0.00		0.38	0.00	0.58	0.01						0.58		
C-OABG	AS01-TP21	AS01-TP21-0910	03/26/08	9	10	SB				0.01											0.23	0.00		0.37	0.00	0.52	0.01						0.52		
C-OABG	AS01-TP22	AS01-TP22-0910	03/26/08	9	10	SB				0.04										0.00	0.29	0.00		0.43	0.00	0.65	0.01						0.65		
E-OABG	AS01-TP23	AS01-DC12-0102	03/31/08	1	2	SS						0.07				0.09					0.37	0.03	0.24	0.18	0.09	0.54	0.12	0.11	0.21	0.02	0.09	0.07	0.54		
E-OABG	AS01-TP23	AS01-TP23-0910	03/31/08	9	10	SB				0.00											0.28	0.00		0.40	0.00	0.65	0.01	0.00					0.65		
E-OABG	AS01-TP24	AS01-TP24-0910	03/27/08	9	10	SB				0.01										0.00	0.28	0.00		0.44	0.00	0.65	0.01						0.65		
E-OABG	AS01-TP25	AS01-DC13-0304	04/01/08	3	4	SS				0.01										0.00	0.51	0.11	0.74	0.22	0.12	0.72	0.06	0.19	1.20	0.02	0.12	0.22	1.20	Nickel	
E-OABG	AS01-TP25	AS01-TP25-0910	04/01/08	9	10	SB			0.00	0.02										0.00	0.33	0.00		0.44	0.00	0.74	0.04						0.74		
E-OABG	AS01-TP26	AS01-TP26-0910	03/31/08	9	10	SB			0.03	0.04											0.24	0.00		0.42	0.00	0.56	0.01	0.00					0.56		
E-OABG	AS01-TP27	AS01-DC10-0405	03/28/08	4	5	SS			0.02	0.11											0.39	0.08	0.35	0.24	0.18	0.66	0.21	0.28	0.41	0.05	0.09	0.21	0.66		
E-OABG	AS01-TP27	AS01-TP27-0910	03/28/08	9	10	SB			0.02	0.08											0.31	0.01		0.49	0.00	0.70	0.01						0.70		
E-OABG	AS01-TP28	AS01-DC09-0304	03/28/08	3	4	SS			1.00	32.1											0.39	0.43	0.92	0.34	2.36	0.70	0.85	0.93	0.70	1.29	0.15	1.32	32.1	TCE	
E-OABG	AS01-TP28	AS01-TP28-0910	03/28/08	9	10	SB			0.02	14.8											0.29	0.00		0.37	0.00	0.76	0.01						14.8	TCE	
E-OABG	AS01-TP29	AS01-DC08-0304	03/28/08	3	4	SS				86.4										0.01	0.38	0.06	0.28	0.20	0.09	0.72	0.03	3.04	0.25	0.10	0.10	0.24	86.4	TCE	
E-OABG	AS01-TP29	AS01-TP29-0910	03/28/08	9	10	SB				568											0.29	0.00		0.26	0.00	0.70	0.01						568	TCE	
E-OABG	AS01-TP30	AS01-DC05-0203	03/27/08	2	3	SS				0.01					0.06	0.09					0.59	0.48	1.82	0.49	3.08	0.87	0.25	1.24	0.97	0.11	0.11	0.72	3.08	Copper	
E-OABG	AS01-TP30	AS01-TP30-0910	03/27/08	9	10	SB				0.00	0.01	0.05	0.01								0.38	0.01		1.09	0.04	0.60	0.04						1.09	Cobalt	
W-OABG	AS01-TP32	AS01-TP32-0910	03/24/08	9	10	SB				0.04	0.02	0.06	0.01								0.65	0.00		1.00	0.00	0.87	0.06						1.00	Cobalt	
W-OABG	AS01-TP33	AS01-TP33-0607	03/25/08	6	7	SB				0.21											0.31	0.00		0.47	0.00	0.62	0.01						0.62		
C-OABG	AS01-TP34	AS01-TP34-0910	03/26/08	9	10	SB				0.01											0.21	0.00		0.33	0.00	0.48	0.01						0.48		
E-OABG	AS01-TP35	AS01-DC11-0203	03/31/08	2	3	SS															0.29	0.02	0.25	0.19	0.07	0.62	0.06	0.07	0.19	0.03	0.09	0.06	0.62		
E-OABG	AS01-TP35	AS01-TP35-0910	03/31/08	9	10	SB				0.01											0.29	0.01		0.53	0.00	0.68	0.01	0.00					0.68		
E-OABG	AS01-TP36	AS01-DC07-0304	03/27/08	3	4	SS			0.00	284											0.28	0.02	0.18	0.21	0.06	0.46	0.02		0.20	0.00	0.06	0.04	284	TCE	
E-OABG	AS01-TP36	AS01-TP36-0910	03/27/08	9	10	SB			0.00	901										0.04	0.26	0.00		0.39	0.00	0.54	0.01						901	TCE	
E-OABG	AS01-TP37	AS01-DC06-0203	03/27/08	2	3	SS				0.02	0.01		0.01		0.07	0.08					0.63	0.05	0.37	0.38	0.21	0.71	0.07	0.42	0.41	0.09	0.09	0.17	0.71		
E-OABG	AS01-TP37	AS01-TP37-0910	03/27/08	9	10	SB				0.02											0.48	0.01		0.61	0.00	0.60	0.08	0.01					0.61		
E-OABG	AS01-TP38	AS01-TP38-0910	03/27/08	9	10	SB				0.01											0.33	0.00		1.81	0.00	0.64	0.02						1.81	Cobalt	
E-OABG	B1-003	HCS-B1-3-1	07/17/92	1	2	SS															0.28	0.20	1.10	0.28	0.32	0.80	0.22	0.17	0.33	0.03	0.10	0.33	1.10	Chromium	
E-OABG	B1-003	HCS-B1-3-S	07/17/92	0.5	1	SS															0.90	1.32	1.20	0.54	1.22	0.76	1.01	0.35	0.56	0.14	0.20	1.10	1.32	Cadmium	
E-OABG	B1-004	HCS-B1-4-S	07/17/92	0.5	1	SS															0.53	3.28	2.34	0.76	3.08	3.43	15.4	0.62	1.36	0.30	0.10	3.30	15.4	Lead	
E-OABG	B1-011	HCS-B1-11-2	07/17/92	0.5	1	SS															0.80	2.69	2.34	0.51	5.49	2.28	1.26	2.86	1.30	2.44	0.56	2.86	5.49	Copper	
E-OABG	B1-011	HCS-B1-11-S	07/17/92	1	2	SS															0.89	8.85	2.41	0.60	3.38	1.28	8.51	1.55	0.95	0.58	0.18	1.85	8.85	Cadmium	Lead
E-OABG	B1-12S/12	HCS-B1-12-1	11/16/94	0	1	SS																											0.00		
E-OABG	B1-12S/12	HCS-B1-12-S	11/16/94	0	1	SS					0.01		0.00		0.07	0.09																	0.09		
E-OABG	B1-13S/13	HCS-B1-13-1	11/16/94	0	1	SS					0.01	0.03	0.00		0.05	0.04																	0.05		
E-OABG	B1-13S/13	HCS-B1-13-S	11/16/94	0	1	SS																											0.00		
E-OABG	B1-C	HCS-B1-C	07/17/92	0	1	SS														2.31	0.46	0.19	0.23	0.11	0.32	0.29	6.36	1.30	0.15	0.21	0.03	0.25	6.36	Lead	
E-OABG	B1-CS	HCS-B1-CS	06/20/94	1	2	SS																											0.00		
W-OABG	B2-003	HCS-B2-3-4	07/17/92	3	4	SS															0.48		0.74	0.40	0.54	0.80	0.09	0.20	0.70	0.15	0.62	0.35	0.80		
W-OABG	B2-003	HCS-B2-3-S	07/17/92	2	3	SS															0.59	0.30	1.29	0.47	2.29	0.90	2.08	0.75	0.63	1.85	0.19	0.58	2.29	Copper	
W-OABG	B2-004	HCS-B2-4-4	07/17/92	3	4	SS					0.19	0.67	0.07	0.11	0.25	0.64																	0.67		
W-OABG	B2-005	HCS-B2-5-3	07/17/92	2	3	SS					0.08	0.33	0.03		0.10	0.31																	0.33		
W-OABG	B2-006	HCS-B2-6-3	07/17/92	2	3	SS					0.01	0.04	0.00		0.07	0.06																	0.07		
W-OABG	B2-007	HCS-B2-7-3	07/17/92	2	3	SS															0.43		0.36	0.36	0.22	0.85	0.10	0.25	0.48	0.05	0.08	0.14	0.85		
W-OABG	B2-007	HCS-B2-7-S	07/17/92	1	2	SS															0.89	0.11	0.70	0.49	8.50	0.71	0.35	1.68	0.51	2.84	0.48	0.54	8.50	Copper	
W-OABG	B2-010	HCS-B2-10	07/17/92	5	6	SB															0.69	0.29		1.46	0.18	0.95	0.57	0.43					1.46	Cobalt	
W-OABG	B2-C	HCS-B2-C	07/17/92	0.5	1	SS														1.96	0.81	0.39	0.80	0.49	1.38	0.90	0.25	1.99	0.85	1.51	0.44	0.73	1.99	Mercury	
E-OABG	BG-003	HCS-BG-3	07/13/92	3	4	SS				0.01																							0.01		
W-OABG	BG-015	HCS-BG-15	07/13/92	3	4	SS				0.03																							0.03		
E-OABG	BG-023/023S/083	HCS-BG-23S	06/21/94	0	1	SS																											0.00		
E-OABG	BG-084/084S/106	HCS-BG-106	07/13/92	11	12	SB				3.09																							3.09	TCE	

Table 13
Outside Active Burning Grounds - Industrial Removal Scenario (Baseline)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

INDUSTRIAL SRGs - Surface Soil (SS):
INDUSTRIAL SRGs - Subsurface Soil (SB):

COC CONCENTRATION-to-SRG RATIOS

							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)														
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (tota	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc	Maximum Ratio[1]	COC	Other COCs with Ratios > 5
E-OABG	BG-084/084S/106	HCS-BG-84	07/13/92	3	4	SS				0.12																							0.12		
E-OABG	BG-084/084S/106	HCS-BG-84S	06/20/94	0	1	SS				0.14																							0.14		
W-OABG	BG-098/098S	HCS-BG-98S	11/16/94	0	1	SS				33.3	0.01	0.03	0.00		0.07	0.05					0.99		0.55	0.60	0.30	1.08	0.07	0.29	0.65	0.08	0.15	0.18	33.3	TCE	
W-OABG	BG-099	HCS-BG-99	07/13/92	2	3	SS				0.01																							0.01		
W-OABG	BG-099	HCS-BG-99R	07/13/92	2	3	SS				0.01																							0.01		
E-OABG	BG-102/102S	HCS-BG-102	07/13/92	1	2	SS	0.58		1.27	30.9																							30.9	TCE	
E-OABG	BG-102/102S	HCS-BG-102S	11/16/94	0	1	SS			0.03	1.10	0.01	0.04	0.01		0.06	0.05					0.71		0.31	0.74	0.15	0.92	0.05	0.09	0.75		0.12	0.18	1.10	TCE	
E-OABG	BG-110/110S	HCS-BG-110	07/13/92	2	3	SS	60.0			42.0																							60.0	1,2-DCE	TCE
E-OABG	BG-110/110S	HCS-BG-110S	11/16/94	0	1	SS	35.6			32.1	0.01	0.03	0.00		0.06	0.04					0.64		0.28	1.06	0.13	0.81	0.05	0.06	0.97		0.11	0.20	35.6	1,2-DCE	TCE
W-OABG	BG-112	HCS-BG-112	07/13/92	2	3	SS	0.07			0.07																							0.07		
W-OABG	BG-112	HCS-BG-112R	07/13/92	2	3	SS				0.02																							0.02		
W-OABG	BG-113	HCS-BG-113	07/13/92	2	3	SS				116																							116	TCE	
W-OABG	BG-113	HCS-BG-113S	11/15/94	0	1	SS				9.88	0.01	0.04	0.01	0.03	0.07	0.07					0.93	0.18	0.47	0.71	0.20	0.99	0.07	0.30	0.68	0.06	0.14	0.16	9.88	TCE	
W-OABG	BG-134	HCS-BG-134	11/16/94	2	3	SS	5.11			284																							284	TCE	1,2-DCE
W-OABG	BG-135	HCS-BG-135	11/16/94	2	3	SS			0.00	0.09																							0.09		
W-OABG	BG-136	HCS-BG-136	11/16/94	2	3	SS	0.02			0.90																							0.90		
W-OABG	BG-137	HCS-BG-137	11/16/94	2	3	SS				0.01																							0.01		
W-OABG	BG-138	HCS-BG-138	11/16/94	2	3	SS	2.89			173																							173	TCE	
W-OABG	BG-139	HCS-BG-139	11/15/94	2	3	SS				5.43																							5.43	TCE	
W-OABG	BG-140	HCS-BG-140	11/15/94	2	3	SS	0.00			0.05																							0.05		
W-OABG	BG-141	HCS-BG-141	11/16/94	2	3	SS				0.01																							0.01		
W-OABG	BG-142	HCS-BG-142	11/16/94	2	3	SS	0.03			0.20																							0.20		
E-OABG	BG-143	HCS-BG-143	11/16/94	2	3	SS				0.02																							0.02		
E-OABG	BG-144	HCS-BG-144	11/16/94	2	3	SS				0.03																							0.03		
E-OABG	BG-145	HCS-BG-145	11/16/94	2	3	SS	0.00			0.01																							0.01		
E-OABG	BG-146	HCS-BG-146	11/16/94	2	3	SS			2.00	24.7																							24.7	TCE	
E-OABG	BG-147	HCS-BG-147	11/16/94	2	3	SS	1.87		0.44	65.4																							65.4	TCE	
E-OABG	BG-148	HCS-BG-148	11/16/94	2	3	SS	53.3		0.15	79.0																							79.0	TCE	1,2-DCE
E-OABG	BG-149	HCS-BG-149	11/16/94	2	3	SS				7.90																							7.90	TCE	
W-OABG	BG-150	HCS-BG-150	11/15/94	2	3	SS				21.0	0.01	0.04			0.05	0.07					0.52		0.21	0.39	0.12	0.71	0.04	0.14	0.40	0.05	0.10	0.11	21.0	TCE	
W-OABG	BG-151	HCS-BG-151	03/04/95	2	3	SS			0.00																								0.00		
W-OABG	BG-154	HCS-BG-154	10/27/98	2	3	SS																											0.00		
W-OABG	BG-155	HCS-BG-155	10/27/98	2	3	SS																											0.00		
W-OABG	BG-156	HCS-BG-156	10/27/98	2	3	SS	0.12			1.11																							1.11	TCE	
W-OABG	BG-157	HCS-BG-157	10/27/98	2	3	SS																											0.00		
W-OABG	BG-158	HCS-BG-158	10/27/98	2	3	SS	15.8			56.8																							56.8	TCE	1,2-DCE
W-OABG	BG-159/160	HCS-BG-159	10/27/98	2	3	SS				0.03																							0.03		
W-OABG	BG-159/160	HCS-BG-160	10/27/98	4	6	SB				0.07																							0.07		
W-OABG	BG-163/164	HCS-BG-163	10/27/98	2	3	SS				0.03																							0.03		
W-OABG	BG-163/164	HCS-BG-164	10/27/98	4	6	SB				0.00																							0.00		
W-OABG	BG-166	HCS-BG-166	10/27/98	2	3	SS	0.01			114																							114	TCE	
W-OABG	BG-167/168	HCS-BG-167	10/27/98	2	3	SS				63.0																							63.0	TCE	
W-OABG	BG-167/168	HCS-BG-168	10/27/98	4	6	SB	0.00			0.89																							0.89		
E-OABG	BG-169	HCS-BG-169	10/27/98	2	3	SS																											0.00		
E-OABG	BG-170	HCS-BG-170	10/27/98	2	3	SS				0.01																							0.01		
E-OABG	BG-172	HCS-BG-172	10/27/98	2	3	SS			0.04	0.86																							0.86		
E-OABG	BG-173	HCS-BG-173	10/27/98	2	3	SS			0.00	0.48																							0.48		
E-OABG	BG-174	HCS-BG-174	10/27/98	2	3	SS	0.01			444																							444	TCE	
E-OABG	BG-175/176	HCS-BG-175	10/27/98	2	3	SS				0.12																							0.12		
E-OABG	BG-175/176	HCS-BG-176	10/27/98	4	6	SB				0.65																							0.65		
E-OABG	BG-177/178	HCS-BG-177	10/27/98	2	3	SS				0.05																							0.05		
E-OABG	BG-177/178	HCS-BG-178	10/27/98	4	6	SB				0.20																							0.20		

1 - Red shading indicates maximum ratios >5; orange shading indicates maximum ratios between 1 and 5;
green shading indicates low magnitude (ratio ≤1.5) metal SRG exceedances
Gray shaded concentrations indicate detections; NA - Not Analyzed

Notes:
µg/kg = microgram per kilogram
COC = constituent of concern
ft = foot
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification
mg/kg = milligram per kilogram
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
SRG = site remediation goal
VOC = volatile organic compound

Table 14
Outside Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
						COC CONCENTRATIONS	VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
						INDUSTRIAL SRGs - Surface Soil (SS):	450	300	1,100	810	8,800	2,100	21,000	2,100	29,000	18,000	10,000	370	120	9.60E-05	16.0	17.4	42.7	52.3	253	35,600	785	1.61	78.4	42.6	173	1,170
						INDUSTRIAL SRGs - Subsurface Soil (SB):	8,400	N/A	1,100	810	8,800	2,100	21,000	2,100	N/A	N/A	N/A	370	120	1.80E-04	16.0	130	N/A	20.9	11,000	33,000	830	39.0	N/A	N/A	N/A	N/A
W-OABG	22C-1	22C-1-T	10/26/95	0	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	52	52	NA	6.6	2.7	19.3	10.6	25.6	28,300	74.9	0.42	21.4	7.7	18.9	123
W-OABG	22C-2	22C-2-T	10/26/95	0	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38	38	NA	1.5	0.58	7	1.6	5.2	6,820	6.5	0.06	2.3	1.6	10.3	23.6
W-OABG	22D-1	22D-1-D	10/26/95	2	4	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.5	1.1	13.6	13	22.1	26,900	22.1	0.55	17	0.82	21.6	88.6
W-OABG	22D-1	22D-1-T	10/26/95	0	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.3	2	22	5	33.9	12,400	80.1	5.3	8.4	11.6	15.9	261
W-OABG	AOCM-1	AOCM-1-T	10/26/01	0	1	SS	NA	14	14	14	140	130	160	460	1,714	1,291	NA	NA	NA	NA	16.6	0.84	15.6	42.8	46	31,200	53.3	0.34	60.9	2.6	37.1	220
W-OABG	AOCM-2	AOCM-2-T	10/26/01	0	1	SS	NA	13	13	13	100	83	100	420	1,708	867	NA	NA	NA	NA	9.6	0.76	13	24	33.3	20,600	43.5	0.31	38.2	2	41.2	144
E-OABG	AS01-SB21	AS01-SS21-(0-1)	10/25/01	0	1	SS	NA	12	12	82,000	61	55	97	390	1,605	1,082	NA	NA	NA	NA	13.1	12.4	43.3	23.7	526	33,800	1,120	4.7	47.4	70.3	44.6	1,030
E-OABG	AS01-SB22	AS01-SS22-(0-1)	10/25/01	0	1	SS	NA	11	11	65,000	78	79	110	380	1,580	1,049	NA	NA	NA	NA	19.3	6.5	224	34.5	1,080	57,900	337	2.5	240	61	332	1,360
W-OABG	AS01-SB23	AS01-SS23-(0-1)	10/26/01	0	1	SS	NA	12	12	12	110	120	190	390	1,685	1,146	NA	NA	NA	NA	10.2	0.69	22.5	18.9	57.4	24,700	46	0.24	29.3	12.1	24.3	235
W-OABG	AS01-SB24	AS01-SB24-(1-2)	10/24/01	1	2	SS	NA	11	11	11	350	350	350	350	1,195	1,575	NA	NA	NA	NA	11.9	0.67	12.3	24.3	50.7	20,900	59.1	0.26	34.1	1.1	12.6	148
W-OABG	AS01-SB24	AS01-SS24-(0-1)	10/24/01	0	1	SS	NA	11	11	11	760	680	840	51	3,682	6,291	NA	NA	NA	NA	14.4	0.77	11.6	58.2	41	25,800	42.4	0.29	79.5	1.8	16.5	231
W-OABG	AS01-SB25	AS01-SB25-(1-2)	10/24/01	1	2	SS	NA	11	11	11	58,000	55,000	65,000	2,100	240,060	492,100	NA	NA	NA	NA	7.3	0.64	10	16.2	27.8	16,900	21.8	0.45	25	1.9	10.4	131
W-OABG	AS01-SB25	AS01-SS25-(0-1)	10/24/01	0	1	SS	NA	12	12	12	680	750	970	390	3,453	6,205	NA	NA	NA	NA	18.2	0.93	15.4	55.6	48.2	32,300	47.6	0.28	77.3	4	22.2	246
W-OABG	AS01-SB26	AS01-SB26-(1-2)	10/23/01	1	2	SS	NA	12	12	25,000	130	130	170	400	1,760	1,338	NA	NA	NA	NA	20.6	0.72	20.8	28	64.9	36,500	73.4	0.7	42.1	1.2	21.4	212
W-OABG	AS01-SB26	AS01-SS26-(0-1)	10/23/01	0	1	SS	NA	13	13	120	180	160	240	430	1,867	2,109	NA	NA	NA	NA	18.4	0.77	17.9	43.9	55.2	34,500	55.1	0.18	83.7	1.3	25.7	207
W-OABG	AS01-SB27	AS01-SB27-(1-2)	10/23/01	1	2	SS	NA	12	12	12	180	190	330	360	1,314	1,916	NA	NA	NA	NA	14.7	0.72	16.8	20.4	37.3	31,500	38.7	0.35	28.7	1.2	19.7	127
W-OABG	AS01-SB27	AS01-SS27-(0-1)	10/23/01	0	1	SS	NA	14	14	18	180	170	260	420	1,781	1,832	NA	NA	NA	NA	11	0.8	11.4	38.7	40.2	21,900	46.7	0.14	56	1.3	16.3	168
W-OABG	AS01-SB28	AS01-SS28-(0-1)	10/26/01	0	1	SS	NA	12	12	9.1	100	100	120	410	1,765	970	NA	NA	NA	NA	13	0.74	12.6	41.8	37.4	26,800	42.2	0.69	59.5	1.2	18.8	176
E-OABG	AS01-SB29	AS01-SS29-(0-1)	10/26/01	0	1	SS	NA	13	13	13	83	84	98	420	1,740	1,228	620	62,000	620	NA	14.4	0.75	13.4	39.7	35.6	26,800	45.3	0.16	54	1.3	23.2	161
E-OABG	AS01-SB30	AS01-SB30-(1-2)	10/24/01	1	2	SS	NA	12	6.1	13,000	370	330	320	390	2,314	3,165	590	59,000	590	1.22E-05	31	12.4	112	40.3	332	122,000	2,540	4.5	63.6	43.1	26.6	999
E-OABG	AS01-SB30	AS01-SS30-(0-1)	10/24/01	0	1	SS	NA	14	14	26	220	240	290	440	1,844	2,286	670	67,000	670	3.72E-06	10.5	0.82	9.5	51.1	36.2	18,900	38.1	0.14	75.4	1.4	13.4	206
W-OABG	AS01-SB33	AS01-SS33-(0-1)	10/26/01	0	1	SS	NA	12	12	12	250	220	270	410	2,120	1,931	610	61,000	610	1.36E-05	17.9	0.75	15.3	41.7	45	33,600	40.8	0.18	58.3	1.7	20.7	189
W-OABG	AS01-SB34	AS01-SB34-(1-2)	10/25/01	1	2	SS	NA	12	12	23	210	190	280	390	1,570	2,116	600	60,000	600	7.28E-05	15.0	12.6	37.1	40.7	999	40,900	210	0.57	73.7	95.3	80.3	1,080
W-OABG	AS01-SB34	AS01-SS34-(0-1)	10/25/01	0	1	SS	NA	13	13	4.4	340	340	380	420	1,811	3,020	630	63,000	630	NA	16.5	0.93	15.0	60	59.8	32,300	49.7	0.41	78.9	9.8	21.4	283
W-OABG	AS01-SB35	AS01-SS35-(0-1)	10/26/01	0	1	SS	NA	12	12	12	160	180	120	400	1,485	1,440	580	58,000	580	5.54E-06	13.8	0.72	13	39.3	37.5	27,800	47.2	0.18	54.5	1.7	18.9	186
W-OABG	AS01-SB36	AS01-SB36-(1-2)	10/25/01	1	2	SS	NA	11	11	11	60	62	55	360	1466	817	540	54,000	540	1.43E-05	10	1.3	12.5	15.6	46.5	24,400	44.3	0.14	22.9	6	13.5	220
W-OABG	AS01-SB36	AS01-SS36-(0-1)	10/25/01	0	1	SS	NA	13	13	13	100	100	150	430	1,560	1,281	650	65,000	650	1.78E-05	17.9	0.78	16.5	41	44.9	34,800	48.3	0.18	56.7	1.3	22.6	204
W-OABG	AS01-SB37	AS01-SS37-(0-1)	10/26/01	0	1	SS	NA	13	13	13	160	150	260	420	1,692	1,460	620	62,000	620	2.34E-05	12.9	0.75	20.7	29.5	161	25,000	103	0.28	47	3	32.2	362
W-OABG	AS01-SB38	AS01-SB38-(1-2)	10/26/01	1	2	SS	NA	11	11	11	170	170	190	370	1,529	1,506	560	56,000	560	7.43E-07	10.7	0.67	14	15.2	23.1	28,300	28.2	0.11	18.8	1.1	19.5	78.1
W-OABG	AS01-SB38	AS01-SS38-(0-1)	10/26/01	0	1	SS	NA	12	12	12	150	150	200	390	1,695	1,488	590	59,000	590	1.84E-05	9.1	0.7	13.5	21.5	27.8	20,700	37.1	0.12	31.8	1.2	21.8	108
W-OABG	AS01-SB39	AS01-SB39-(1-2)	10/23/01	1	2	SS	NA	12	12	16,000	310	310	360	380	2,118	2,980	NA	NA	NA	NA	21.5	0.8	23.9	28.4	72	34,200	88.6	0.79	43.1	1.2	20.7	226
W-OABG	AS01-SB39	AS01-SS39-(0-1)	10/23/01	0	1	SS	NA	13	13	180	120	110	170	380	1,530	1,286	NA	NA	NA	NA	13.1	0.78	12.3	38.3	37.5	23,100	43.3	0.12	54.5	1.3	16.1	165
E-OABG	AS01-SB40	AS01-SB40-(1-2)	10/24/01	1	2	SS	NA	12	8.9	15	300	310	440	370	2,248	3,195	580	58,000	580	5.86E-06	10	0.69	13.1	19.6	32	21,000	56.2	0.36	25.1	1.2	13.5	110
E-OABG	AS01-SB40	AS01-SS40-(0-1)	10/24/01	0	1	SS	NA	13	13	23	140	140	170	370	1,525	1,432	630	63,000	630	5.35E-05	24.9	84.7	29.8	43	972	70,900	416	0.17	79.4	1.2	29.7	1,400
E-OABG	AS01-SB41	AS01-SB41-(1-2)	10/24/01	1	2	SS	NA	11	11	29	220	220	250	350	1,745	1,975	570	57,000	570	1.01E-06	14.2	0.68	11.9	21	38.7	26,800	44.8	0.26	30.9	1.1	15.2	160
E-OABG	AS01-SB41	AS01-SS41-(0-1)	10/24/01	0	1	SS	NA	12	12	12	180	180	240	400	1,438	1,875	620	62,000	620	1.01E-05	16.3	0.81	14.3	44	43.7	29,500	51.8	0.17	63.3	1.2	22.2	192
W-OABG	AS01-SB46	AS01-SS46-0-1	07/20/04	0	1	SS	NA	2.9	12	12	78	88	150	NA	887	718	NA	NA	NA	NA	11.1	0.54	14.2	46.8	37.8	29,500	39.7	0.17	64.4	0.97	18.3	191
W-OABG	AS01-SB47	AS01-SS47-0-1	07/20/04	0	1	SS	NA	12	12	12	130	140	230	NA	659	1,094	NA	NA	NA	NA	11.9	0.25	15.7	41.8	46.6	31,300	43.6	0.96	60.2	2.9	21.3	217
W-OABG	AS01-SB48	AS01-SS48-0-1	07/20/04	0	1	SS	NA	850	610	3,600	64	81	150	NA	834	653	NA	NA	NA	NA	8.5	0.3	14.1	23.4	43.1	28,000	44.3	1	36.6	3.3	21.8	161
W-OABG	AS01-SB49	AS01-SS49-0-1	07/20/04	0	1	SS	NA	450	620	990	7,500	9,000	21,000	NA	14,760	72,300	NA	NA	NA	NA	12.4	0.069	19.7	34.6	43.5	32,300	44.9	0.36	54.5	0.54	21.8	181
E-OABG	AS01-SB50	AS01-SS50-0-1	07/21/04	0	1	SS	NA	11	14	14	24	24	45	NA	839	220	NA	NA	NA	2.63E-06	5.9	0.067	10.4	10.7	17.4	21,000	73	0.091	15.3	0.22	16.1	63.2
E-OABG	AS01-SB51	AS01-SS51-0-1	07/21/04	0	1	SS	NA	320	730	2,700	31	36	63	NA	886	280	NA	NA	NA	4.26E-05	8.5	13	23.5	23.9	123	31,100	223	0.26	37	1	26.5	845
E-OABG	AS01-SB52	AS01-SS52-0-1	07/21/04	0	1	SS	NA	300	560	6,400	46	55	91	NA	1026	426	NA	NA	NA	1.20E-04	8.6	4.5	42.7	20.3	253	57,100	591	2.1	50	2.4	22.4	1,170
E-OABG	AS01-SB53	AS01-SS53-0-1	07/21/04	0	1	SS	NA	1,800	1,800	36,000	34	40	75	NA	959	317	NA	NA	NA	1.34E-04	12.5	11	63.8	20	284	28,700	1,310	1	70.5	42.6	173	1,400
E-OABG	AS01-SB54	AS01-SS54-0-1	07/21/04	0	1	SS	NA	13	13	13	99	120	240	NA	954	972	NA	NA	NA	1.83E-05	12.8	0.3	17.1	37.1	44.1	32,400	47.4	0.3	56.6	0.45	25.4	176
W-OABG	AS01-SB56	AS01-SS56-0-1	07/21/04	0	1	SS	NA	NA	NA	NA	87	100	160	NA	960	826	NA	NA	NA	1.64E-05	11.8	0.4	15.6	42.8	41	31,600	38	0.25	59.7	1.2	21.9	200
W-OABG	AS01-SB57	AS01-SS57-0-1	07/21/04	0	1	SS	NA	NA	NA	NA	8,100	12,000	16,000	NA	63,100	82,500	NA	NA	NA	2.65E-05	11.2	5.2	59.5	15.8	517	30,400	939	0.44	45.5	5.5	58.3	841
E-OABG	AS01-SB58	AS01-SS58-0-1	07/21/04	0	1	SS	NA	NA	NA	NA	70	88	170	NA	843	709	NA	NA	NA	4.37E-05	11.2	0.46	14	39.7	39.8	28,700	43.7	0.23	57.4	0.24	22.1	180
E-OABG	AS01-SB59	AS01-SS59-0-1	07/21/04	0	1	SS	NA	NA	NA	NA	99	110	200	NA	976	865	NA	NA	NA	1.19E-05	12.7	0.37	16.4	42	44.1	32,400	45.3	0.24	62.9	0.25	24.9	181
E-OABG	AS01-SB71	AS01-SB71-1_5-2	09/23/04	1.5	2	SS	NA	14	26	13	440	440	51	440	1665	1639	1,500	2,500	140	2.16E-06	7	0.44	14.2	13.4	22.5	23,600	39.2	0.27	20.8	0.69	14.2	78.9
E-OABG	AS01-SB71	AS01-SS71-0-0_5	09/23/04	0	1	SS	NA	15	15	15	500	500	500	500	2,050	2,250	500	2,500	82	5.27E-06	9.5	1.8	15.1	27	35.6	28,700	61.5	0.23	42.8	0.7	23.4	179
E-OABG	AS01-SB72	AS01-SB72-4_5-5	09/23/04	4.5	5	SB	NA	2,800	11,000	77,000	470	470	470	470	2,115	2,115	75,000	30,000	1,800	1.85E-04	3.9	143	38.1	20.2	436	29,800	810	22.7	38.7	13.3	14.3	2,060
E-OABG	AS01-SB72	AS01-SS72-0-0_5	09/23/04	0	1	SS	NA	1,600	420	4,400	450	450	450	450	2,025	2,025	530,000	500	7,300	3.48E-04	7.2	373	319	27.7	248	54,200	814	56.3	56.0	12.3	17.8	2,060
E-OABG	AS01-SB73	AS01-SB73-1_5-2	09/23/04	1.5	2	SS	NA	12,000	12,000	170,000	400	400	400	400	1,800	1,800	76	2,500	500	2.09E-06	7.1	0.35	12.6	15	21.8	27,700	20.5	0.17	22.5	0.38	16.5	79.2
E-OABG	AS01-SB73	AS01-SS73-0-0_5	09/23/04	0	1	SS	NA	1,300	1,300	22,000	390	390	390	390	1,755	1,755	120	2,500	500	2.40E-05	8.7	2.1	37.6	16.3	172	40,700	111	0.42	37	41.2	30.2	311
E-OABG	AS01-SB74	AS01-SB74-4-4_5	09/23/04	4	5	SS	NA	15	3.3	57	460	460	460	460	2,070	2,070	100	2,500	500	6.82E-06	7	11.6	282	53.9	13,600	33,500	865	0.17	347	19.5	53.4	1,010
E-OABG	AS01-SB74	AS01-SS74-0-0_5	09/23/04	0	1	SS	NA	12	12	4.9	430	430	430	430	1,599	1,935	500	2,500	500	6.64E-06	7.5	0.7	31.1	18.5	94.9	31,600	66.8	0.34	29.3	0.97	19.5	182
W-OABG	AS01-TP02	AS01-TP02-0910	03/18/08	9	10	SB	NA	10	10	10	380	380	380	380	1,710	1,710	620	4,000	620	7.83E-08	6.6	0.43	13.4	6.7	16.4	32,900	9.7	0.11	19.2	1.1	16.3	64.9
W-OABG	AS01-TP03	AS01-TP03-0910	03/18/08	9	10	SB	NA	10	10	10	390	390	390	390	1,755	1,755	620	4,000	620	3.19E-07	5	0.23	10.7	11.6	14.3	24,200	11	0.11	14.5	1.2	16.2	49.2
W-OABG	AS01-TP04	AS01-TP04-0910	03/18/08	9	10	SB	NA	12	12	12	410	410	410	410	1,845	1,845	620	4,000	620	1.82E-07	4	0.2	8.8	7	9.2	19,700	8	0.12	13.2	1.2	11.8	43.7
W-OABG	AS01-TP05	AS01-DC01-0506	03/19/08	5	6	SB	NA	12	12	7,600	150	190	240	400	1,760	1,780	620	4,000	620	1.44E-04	6.2	8.2	27.2	20.3	704	27,500	178	5	46.1	104	57.2	1,440
W-OABG	AS01-TP05	AS01-TP05-0910	03/19/08	9	10	SB	NA	12	12	32	180	150	220	430	2,115	1,785	620	4,000	620	7.60E-05	6.7	6.6	19.3	17	278	28,800	153	2.7	40.6	69.6	70.8	420
W-OABG	AS01-TP06	AS01-TP06-0910	03/19/08	9	10	SB	NA	12	12	44	400	400	400	400	1,800	1,800	620	4,000	620	3.51E-07	4.6	0.27	13.2	3.7	9.4	26,900	6.7	0.12	11.6	0.19	13.2	51.1
W-OABG	AS01-TP07	AS01-DC03-0304	03/20/08	3	4	SS	NA	10	10	10	420	420	420	420	1,687	1,790	620	4,000	620	1.50E-05	7.9	1	27.7	13.4	563	33,400	99.4	0.043	27.9	1.3	19.3	926
W-OABG	AS01-TP07	AS01-TP07-0910	03/20/08	9	10	SB	NA	11	11	11	400	400	400	400	1,800	1,800	620	4,000	620	7.68E-08	5.6	0.23	12.5	6.8	17.2	25,900	9.9	0.063	14.1	1.2	15.6	67.9
W-OABG	AS01-TP08	AS01-TP08-0910	03/20/08	9	10	SB	NA	10	10	10	390	390	390	390	1,755	1,755	620	4,000	620	1.31E-07	4.3	0.23	9.8	8.5	11.4	20,700	9.1	0.12	12.7	0.17	13	44.5
W-OABG	AS01-TP09	AS01-DC02-0405	03/20/08	4	5	SS	NA	10	10	15	410	100	110	410	1,685	1,128	620	4,000	620	3.09E-05	7.2	8.3	36.8	13.2	69.3	23,600	179	0.12	203	1.6	994	721
W-OABG	AS01-TP09	AS01-TP09-0910	03/20/08	9	10	SB	NA	11	11	22	380	380	380	380	1,710	1,710	620	4,000	620	3.09E-07	4.9	0.2	11.5	13.1	16.9	24,700	12.2	0.11	17	1.2	18.8	62.2
W-OABG	AS01-TP10	AS01-TP10-0910	03/24/08	9	10	SB	NA	12	12	85	430	430	430	430	1,935	1,935	NA	NA	NA	NA	5	0.27	11.6	12.3	15.8	26,400	11.7	0.13	16.4	1.3	17.4	59.7
W-OABG	AS01-TP11	AS01-TP11-0910	03/24/08	9	10	SB	NA	16	16	24	490	490	490	490	2,080	2,080	620	4,000	620	NA	7.1	0.33	10.1	14.3	28.5	22,100	31.3	0.081	24.3	1.5	12.5	106
W-OABG	AS01-TP12	AS01-TP12-0809	03/25/08	8	9	SB	NA	12	12	150	480	480	480	480	2,160	2,160	NA	NA	NA	NA	5.9	0.29	10.9	10.1	15.8	26,700	11.9	0.049	15.7	1.4	17.5	61.4
W-OABG	AS01-TP13	AS01-TP13-0910	03/25/08	9	10	SB	NA	12	12	6,900	470	470	470	470	2,115	2,115	620	4,000	620	NA	4.7	0.29	10	10.4	11.5	20,600	10.1	0.14	17.3	1.4	13.3	51.5

Table 14
Outside Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATIONS																									
							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
						INDUSTRIAL SRGs - Surface Soil (SS):	450	300	1,100	810	8,800	2,100	21,000	2,100	29,000	18,000	10,000	370	120	9.60E-05	16.0	17.4	42.7	52.3	253	35,600	785	1.61	78.4	42.6	173	1,170
						INDUSTRIAL SRGs - Subsurface Soil (SB):	8,400	N/A	1,100	810	8,800	2,100	21,000	2,100	N/A	N/A	N/A	370	120	1.80E-04	16.0	130	N/A	20.9	11,000	33,000	830	39.0	N/A	N/A	N/A	N/A
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
W-OABG	AS01-TP14	AS01-DC04-0304	03/25/08	3	4	SS	NA	13	13	26,000	490	490	490	490	2,205	2,205	620	4,000	620	NA	5.1	0.31	9.4	11.6	20.6	19,600	14.5	0.062	18.9	0.18	13	61.6
W-OABG	AS01-TP14	AS01-TP14-0910	03/25/08	9	10	SB	NA	15	15	92,000	520	520	520	520	2,090	2,190	620	4,000	620	NA	9.2	0.6	14.4	19.1	42.3	25,700	36.5	0.71	29.7	0.31	16.1	125
W-OABG	AS01-TP15	AS01-TP15-0910	03/25/08	9	10	SB	NA	13	13	11,000	470	470	470	470	2,115	2,115	NA	NA	NA	NA	4.6	0.26	10.2	10.1	11.2	21,800	10	0.14	16.8	1.4	13.6	53.9
C-OABG	AS01-TP16	AS01-TP16-0809	03/25/08	8	9	SB	NA	16	16	62	500	500	500	500	2,050	2,000	620	4,000	620	8.28E-06	11.2	0.74	14.7	26.2	46.3	32,100	42.3	0.35	41.1	0.27	19.2	161
C-OABG	AS01-TP17	AS01-TP17-0809	03/25/08	8	9	SB	NA	14	14	14	470	470	470	470	1,885	1,990	620	4,000	620	4.70E-05	10.1	0.79	13.8	22.9	38.7	29,800	34.9	0.14	37	0.25	17.8	136
C-OABG	AS01-TP18	AS01-TP18-0910	03/26/08	9	10	SB	NA	10	10	10	380	380	380	380	1,710	1,710	620	4,000	620	NA	4.6	0.24	9.5	9.1	10.9	20,700	9.3	0.12	12.2	1.1	12.9	41.3
C-OABG	AS01-TP19	AS01-TP19-0910	03/26/08	9	10	SB	NA	10	10	6	390	390	390	390	1,755	1,755	NA	NA	NA	NA	3.8	0.21	7.7	8.5	10	17,600	8.3	0.12	10.4	1.2	11.1	35.3
C-OABG	AS01-TP20	AS01-TP20-0910	03/26/08	9	10	SB	NA	10	10	10	390	390	390	390	1,755	1,755	620	4,000	620	NA	3.8	0.21	8	8	10.1	19,300	8.3	0.12	11.6	1.2	12	41
C-OABG	AS01-TP21	AS01-TP21-0910	03/26/08	9	10	SB	NA	10	10	7	380	380	380	380	1,710	1,710	620	4,000	620	NA	3.7	0.19	8.2	7.8	10.3	17,200	10.1	0.12	11.3	1.2	11.2	37.1
C-OABG	AS01-TP22	AS01-TP22-0910	03/26/08	9	10	SB	NA	10	10	30	380	380	380	380	1,710	1,710	620	4,000	620	8.60E-08	4.7	0.26	9.1	8.9	9.7	21,400	8.6	0.12	13.3	1.2	12.3	47
E-OABG	AS01-TP23	AS01-DC12-0102	03/31/08	1	2	SS	NA	11	11	11	400	150	400	400	1,800	1,680	620	4,000	620	NA	5.9	0.45	10.4	9.6	22.4	19,300	93.7	0.17	16.2	0.67	15.9	81.5
E-OABG	AS01-TP23	AS01-TP23-0910	03/31/08	9	10	SB	NA	10	10	3	390	390	390	390	1,755	1,755	620	4,000	620	NA	4.4	0.12	9.2	8.4	11.8	21,300	11	0.054	12.5	1.2	13.1	41.5
E-OABG	AS01-TP24	AS01-TP24-0910	03/27/08	9	10	SB	NA	10	10	11	380	380	380	380	1,710	1,710	620	4,000	620	4.04E-08	4.4	0.21	9.3	9.2	12.8	21,400	9.3	0.12	12.4	1.2	13.5	42.4
E-OABG	AS01-TP25	AS01-DC13-0304	04/01/08	3	4	SS	NA	13	13	5	400	400	400	400	1,800	1,800	620	4,000	620	4.06E-07	8.2	2	31.7	11.3	29.9	25,800	45.8	0.31	94.1	0.91	20.1	253
E-OABG	AS01-TP25	AS01-TP25-0910	04/01/08	9	10	SB	NA	10	3	17	390	390	390	390	1,755	1,755	620	4,000	620	3.88E-08	5.3	0.26	11.2	9.3	13.8	24,500	29.1	0.12	13.7	1.2	15	48.4
E-OABG	AS01-TP26	AS01-TP26-0910	03/31/08	9	10	SB	NA	11	31	29	400	400	400	400	1,800	1,800	620	4,000	620	NA	3.9	0.22	8.6	8.8	10	18,600	7.5	0.06	14.3	1.2	10.8	43.5
E-OABG	AS01-TP27	AS01-DC10-0405	03/28/08	4	5	SS	NA	10	22	90	400	400	400	400	1,800	1,800	NA	NA	NA	NA	6.3	1.4	15.1	12.8	44.8	23,500	166	0.45	31.8	2.3	15.2	247
E-OABG	AS01-TP27	AS01-TP27-0910	03/28/08	9	10	SB	NA	10	26	62	360	360	360	360	1,620	1,620	NA	NA	NA	NA	5	1.9	11.3	10.2	15.1	23,100	10.9	0.046	17.5	0.72	13.7	51.4
E-OABG	AS01-TP28	AS01-DC09-0304	03/28/08	3	4	SS	NA	1,300	1,100	26,000	400	400	400	400	1,800	1,800	NA	NA	NA	NA	6.3	7.4	39.3	17.8	598	24,900	671	1.5	55.2	54.9	26	1,550
E-OABG	AS01-TP28	AS01-TP28-0910	03/28/08	9	10	SB	NA	10	20	12,000	400	400	400	400	1,800	1,800	620	4,000	620	NA	4.6	0.35	10.5	7.7	12.5	25,000	9.5	0.12	13.4	1.2	15.3	51.8
E-OABG	AS01-TP29	AS01-DC08-0304	03/28/08	3	4	SS	NA	10,000	10,000	70,000	380	380	380	380	1,710	1,710	NA	NA	NA	1.16E-06	6	1	12.1	10.3	23.9	25,700	25.2	4.9	19.3	4.4	16.6	285
E-OABG	AS01-TP29	AS01-TP29-0910	03/28/08	9	10	SB	NA	38,000	38,000	460,000	390	390	390	390	1655	1530	NA	NA	NA	NA	4.7	0.18	9.8	5.5	12.2	23,000	10.4	0.11	11.6	1.2	13	50.2
E-OABG	AS01-TP30	AS01-DC05-0203	03/27/08	2	3	SS	NA	13	13	11	420	420	420	420	1,740	1,674	NA	NA	NA	NA	9.4	8.4	77.7	25.5	779	30,900	197	2	75.9	4.6	19.3	840
E-OABG	AS01-TP30	AS01-TP30-0910	03/27/08	9	10	SB	NA	13	13	3	110	96	130	430	2,005	1,461	620	4,000	620	NA	6.1	0.71	9.3	22.7	489	19,800	30.4	0.072	25.9	0.38	10.8	142
W-OABG	AS01-TP32	AS01-TP32-0910	03/24/08	9	10	SB	NA	15	15	31	150	120	130	500	2,300	1,710	NA	NA	NA	NA	10.4	0.49	14.3	20.9	54.7	28,700	53.7	0.18	36.7	0.39	17.3	155
W-OABG	AS01-TP33	AS01-TP33-0607	03/25/08	6	7	SB	NA	13	13	170	490	490	490	490	2,205	2,205	NA	NA	NA	NA	4.9	0.27	9.1	9.9	16.1	20,600	12.1	0.099	17	1.5	12.3	55
C-OABG	AS01-TP34	AS01-TP34-0910	03/26/08	9	10	SB	NA	10	10	9	380	380	380	380	1,710	1,710	NA	NA	NA	NA	3.4	0.17	7.4	7	8.8	16,000	7.1	0.12	8.8	1.2	10	31.3
E-OABG	AS01-TP35	AS01-DC11-0203	03/31/08	2	3	SS	NA	11	11	11	390	390	390	390	1,755	1,755	620	4,000	620	NA	4.6	0.43	10.7	9.9	18.1	22,100	47.3	0.12	15.1	1.2	16.2	65.5
E-OABG	AS01-TP35	AS01-TP35-0910	03/31/08	9	10	SB	NA	10	10	12	390	390	390	390	1,755	1,755	NA	NA	NA	NA	4.7	1.9	10.1	11	12	22,600	10.1	0.04	14	0.57	14.2	48.3
E-OABG	AS01-TP36	AS01-DC07-0304	03/27/08	3	4	SS	NA	10	2	230,000	340	340	340	340	1,530	1,530	620	4,000	620	NA	4.4	0.35	7.7	11	15.3	16,400	14.3	0.052	15.5	0.17	10.8	49.2
E-OABG	AS01-TP36	AS01-TP36-0910	03/27/08	9	10	SB	NA	14	4	730,000	480	480	480	480	2,160	2,160	620	4,000	620	6.44E-06	4.1	0.28	8.2	8.2	13	17,800	12.1	0.15	13.7	0.25	10.5	49.3
E-OABG	AS01-TP37	AS01-DC06-0203	03/27/08	2	3	SS	NA	14	14	16	97	430	110	430	1,905	1,482	NA	NA	NA	NA	10	0.91	15.7	19.9	52.6	25,100	58.7	0.68	31.8	4	16.4	197
E-OABG	AS01-TP37	AS01-TP37-0910	03/27/08	9	10	SB	NA	12	12	19	420	420	420	420	1,890	1,890	NA	NA	NA	NA	7.6	0.73	10	12.7	32.3	19,800	62.4	0.25	21.4	0.7	12.6	196
E-OABG	AS01-TP38	AS01-TP38-0910	03/27/08	9	10	SB	NA	13	13	9	450	450	450	450	2,025	2,025	620	4,000	620	NA	5.2	0.59	7.7	37.8	43.5	21,100	20.5	0.055	30.4	1.4	9.5	114
E-OABG	B1-003	HCS-B1-3-1	07/17/92	1	2	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.5	3.4	46.9	14.5	79.9	28,400	173	0.28	25.7	1.1	17.9	383
E-OABG	B1-003	HCS-B1-3-S	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.4	22.9	51.4	28.4	309	27,200	793	0.56	44.2	5.8	34.7	1,290
E-OABG	B1-004	HCS-B1-4-S	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.4	57.1	100	39.8	780	122,000	12,100	1	107	12.6	18.1	3,860
E-OABG	B1-011	HCS-B1-11-2	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.8	46.8	99.8	26.8	1,390	81,100	993	4.6	102	104	97.5	3,350
E-OABG	B1-011	HCS-B1-11-S	07/17/92	1	2	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.2	154	103	31.6	855	45,700	6,680	2.5	74.1	24.8	30.3	2,160
E-OABG	B1-12S/12	HCS-B1-12-1	11/16/94	0	1	SS	NA	NA	NA	NA	380	380	380	380	1,710	1,710	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	B1-12S/12	HCS-B1-12-S	11/16/94	0	1	SS	NA	NA	NA	NA	68	500	92	500	2,020	1,617	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	B1-13S/13	HCS-B1-13-1	11/16/94	0	1	SS	NA	NA	NA	NA	88	70	82	370	1544	737	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	B1-13S/13	HCS-B1-13-S	11/16/94	0	1	SS	NA	NA	NA	NA	520	520	520	520	2,340	2,340	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	B1-C	HCS-B1-C	07/17/92	0	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.21E-04	7.3	3.3	10	5.5	81.9	10,500	4,990	2.1	11.4	8.9	5.6	291
E-OABG	B1-CS	HCS-B1-CS	06/20/94	1	2	SS	NA	NA	NA	NA	380	380	380	380	1,710	1,710	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	B2-003	HCS-B2-3-4	07/17/92	3	4	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.7	0.74	31.5	21.1	136	28,500	68.6	0.32	55.1	6.5	108	408
W-OABG	B2-003	HCS-B2-3-S	07/17/92	2	3	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.5	5.3	55.1	24.6	579	31,900	1,630	1.2	49.7	78.8	33.4	679
W-OABG	B2-004	HCS-B2-4-4	07/17/92	3	4	SS	NA	NA	NA	NA	1,700	1,400	1,500	230	7,136	11,530	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	B2-005	HCS-B2-5-3	07/17/92	2	3	SS	NA	NA	NA	NA	700	690	730	390	2,883	5,565	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	B2-006	HCS-B2-6-3	07/17/92	2	3	SS	NA	NA	NA	NA	95	83	100	490	1,918	1,127	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	B2-007	HCS-B2-7-3	07/17/92	2	3	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.9	0.71	15.3	18.9	54.5	30,400	74.6	0.4	38	2.1	14.6	163
W-OABG	B2-007	HCS-B2-7-S	07/17/92	1	2	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.3	1.9	29.8	25.6	2,150	25,100	272	2.7	40.3	121	82.7	636
W-OABG	B2-010	HCS-B2-10	07/17/92	5	6	SB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11	37.5	110	30.6	1,970	31,300	472	16.8	185	106	100	4,230
W-OABG	B2-C	HCS-B2-C	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.88E-04	12.9	6.8	34	25.5	348	31,900	200	3.2	66.4	64.5	75.8	849
E-OABG	BG-003	HCS-BG-3	07/13/92	3	4	SS	6	NA	6	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-015	HCS-BG-15	07/13/92	3	4	SS	6	NA	6	26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-023/023S/083	HCS-BG-23S	06/21/94	0	1	SS	11	NA	11	14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-084/084S/106	HCS-BG-106	07/13/92	11	12	SB	750	NA	750	2,500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-084/084S/106	HCS-BG-84	07/13/92	3	4	SS	6	NA	6	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-084/084S/106	HCS-BG-84S	06/20/94	0	1	SS	11	NA	11	110	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-098/098S	HCS-BG-98S	11/16/94	0	1	SS	1,800	NA	1,800	27,000	110	71	99	460	1,940	923	NA	NA	NA	NA	15.8	3.5	23.6	31.2	75.5	38,600	53.3	0.46	50.8	3.3	26.2	206
W-OABG	BG-099	HCS-BG-99	07/13/92	2	3	SS	6	NA	6	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-099	HCS-BG-99R	07/13/92	2	3	SS	6	NA	6	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-102/102S	HCS-BG-102	07/13/92	1	2	SS	260	NA	1,400	25,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-102/102S	HCS-BG-102S	11/16/94	0	1	SS	71	NA	29	890	100	80	120	450	1,847	980	NA	NA	NA	NA	11.4	2.9	13.1	38.6	37.3	32,600	37.1	0.14	58.8	1.5	20.1	210
E-OABG	BG-110/110S	HCS-BG-110	07/13/92	2	3	SS	27,000	NA	820	34,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-110/110S	HCS-BG-110S	11/16/94	0	1	SS	16,000	NA	1,600	26,000	85	61	84	440	1800	805	NA	NA	NA	NA	10.2	2.3	11.9	55.2	33.7	28,700	38.5	0.1	76.1	1.1	18.8	233
W-OABG	BG-112	HCS-BG-112	07/13/92	2	3	SS	33	NA	7	56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-112	HCS-BG-112R	07/13/92	2	3	SS	7	NA	7	14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-113	HCS-BG-113	07/13/92	2	3	SS	880	NA	880	94,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-113	HCS-BG-113S	11/15/94	0	1	SS	1,800	NA	1,800	8,000	100	85	170	57	1,900	1,331	NA	NA	NA	NA	14.8	3.1	19.9	37.2	49.8	35,200	57.6	0.48	53.3	2.7	24.5	192
W-OABG	BG-134	HCS-BG-134	11/16/94	2	3	SS	2,300	NA	1,500	230,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 14
Outside Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
							COC CONCENTRATIONS																									
							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
						INDUSTRIAL SRGs - Surface Soil (SS):	450	300	1,100	810	8,800	2,100	21,000	2,100	29,000	18,000	10,000	370	120	9.60E-05	16.0	17.4	42.7	52.3	253	35,600	785	1.61	78.4	42.6	173	1,170
						INDUSTRIAL SRGs - Subsurface Soil (SB):	8,400	N/A	1,100	810	8,800	2,100	21,000	2,100	N/A	N/A	N/A	370	120	1.80E-04	16.0	130	N/A	20.9	11,000	33,000	830	39.0	N/A	N/A	N/A	N/A
W-OABG	BG-135	HCS-BG-135	11/16/94	2	3	SS	11	NA	2	73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-136	HCS-BG-136	11/16/94	2	3	SS	11	NA	56	730	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-137	HCS-BG-137	11/16/94	2	3	SS	12	NA	12	7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-138	HCS-BG-138	11/16/94	2	3	SS	1,300	NA	1,700	140,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-139	HCS-BG-139	11/15/94	2	3	SS	1,800	NA	1,800	4,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-140	HCS-BG-140	11/15/94	2	3	SS	2	NA	12	41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-141	HCS-BG-141	11/16/94	2	3	SS	12	NA	12	5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-142	HCS-BG-142	11/16/94	2	3	SS	12	NA	12	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-143	HCS-BG-143	11/16/94	2	3	SS	12	NA	12	15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-144	HCS-BG-144	11/16/94	2	3	SS	12	NA	12	28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-145	HCS-BG-145	11/16/94	2	3	SS	1	NA	12	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-146	HCS-BG-146	11/16/94	2	3	SS	1,600	NA	2,200	20,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-147	HCS-BG-147	11/16/94	2	3	SS	840	NA	480	53,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-148	HCS-BG-148	11/16/94	2	3	SS	24,000	NA	160	64,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-149	HCS-BG-149	11/16/94	2	3	SS	1,500	NA	1,500	6,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-150	HCS-BG-150	11/15/94	2	3	SS	1,500	NA	1,500	17,000	77	74	360	360	1,580	1,301	NA	NA	NA	NA	8.3	2.1	8.8	20.2	31.3	25,200	30.4	0.22	31.3	2.1	17.3	124
W-OABG	BG-151	HCS-BG-151	03/04/95	2	3	SS	12	NA	1	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-154	HCS-BG-154	10/27/98	2	3	SS	11	NA	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-155	HCS-BG-155	10/27/98	2	3	SS	11	NA	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-156	HCS-BG-156	10/27/98	2	3	SS	52	NA	11	900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-157	HCS-BG-157	10/27/98	2	3	SS	11	NA	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-158	HCS-BG-158	10/27/98	2	3	SS	7,100	NA	11	46,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-159/160	HCS-BG-159	10/27/98	2	3	SS	11	NA	11	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-159/160	HCS-BG-160	10/27/98	4	6	SB	11	NA	11	57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-163/164	HCS-BG-163	10/27/98	2	3	SS	11	NA	11	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-163/164	HCS-BG-164	10/27/98	4	6	SB	11	NA	11	4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-166	HCS-BG-166	10/27/98	2	3	SS	3	NA	11	92,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-167/168	HCS-BG-167	10/27/98	2	3	SS	11	NA	11	51,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-167/168	HCS-BG-168	10/27/98	4	6	SB	3	NA	13	720	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-169	HCS-BG-169	10/27/98	2	3	SS	11	NA	11	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-170	HCS-BG-170	10/27/98	2	3	SS	11	NA	11	8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-172	HCS-BG-172	10/27/98	2	3	SS	11	NA	41	700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-173	HCS-BG-173	10/27/98	2	3	SS	11	NA	4	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-174	HCS-BG-174	10/27/98	2	3	SS	6	NA	11	360,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-175/176	HCS-BG-175	10/27/98	2	3	SS	11	NA	11	99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-175/176	HCS-BG-176	10/27/98	4	6	SB	11	NA	11	530	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-177/178	HCS-BG-177	10/27/98	2	3	SS	11	NA	11	42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-177/178	HCS-BG-178	10/27/98	4	6	SB	11	NA	11	160	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
						UCL Current Conditions	2,613	133	602	63,813	3,035	1,760	3,731	231	8,717	26,167	27,577	10,727	2,080	5.95E-05	10.3	31.3	45.8	24.9	778	31,800	881	3.64	62.6	24.8	51.0	701
	STEP 1 (SRG Ratio >10)																															
E-OABG	AS01-TP36	AS01-TP36-0910	03/27/08	9	10	SB	NA	14	4	730,000	480	480	480	480	2,160	2,160	620	4,000	620	6.44E-06	4.1	0.28	8.2	8.2	13	17,800	12.1	0.15	13.7	0.25	10.5	49.3
E-OABG	AS01-TP36	AS01-DC07-0304	03/27/08	3	4	SS	NA	10	2	230,000	340	340	340	340	1,530	1,530	620	4,000	620	NA	4.4	0.35	7.7	11	15.3	16,400	14.3	0.052	15.5	0.17	10.8	49.2
E-OABG	AS01-TP29	AS01-TP29-0910	03/28/08	9	10	SB	NA	38,000	38,000	460,000	390	390	390	390	1655	1530	NA	NA	NA	NA	4.7	0.18	9.8	5.5	12.2	23,000	10.4	0.11	11.6	1.2	13	50.2
E-OABG	AS01-TP29	AS01-DC08-0304	03/28/08	3	4	SS	NA	10,000	10,000	70,000	380	380	380	380	1,710	1,710	NA	NA	NA	1.16E-06	6	1	12.1	10.3	23.9	25,700	25.2	4.9	19.3	4.4	16.6	285
E-OABG	BG-174	HCS-BG-174	10/27/98	2	3	SS	6	NA	11	360,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-134	HCS-BG-134	11/16/94	2	3	SS	2,300	NA	1,500	230,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	AS01-SB73	AS01-SB73-1_5-2	09/23/04	1.5	2	SS	NA	12,000	12,000	170,000	400	400	400	400	1,800	1,800	76	2,500	500	2.09E-06	7.1	0.35	12.6	15	21.8	27,700	20.5	0.17	22.5	0.38	16.5	79.2
E-OABG	AS01-SB73	AS01-SS73-0-0_5	09/23/04	0	1	SS	NA	1,300	1,300	22,000	390	390	390	390	1,755	1,755	120	2,500	500	2.40E-05	8.7	2.1	37.6	16.3	172	40,700	111	0.42	37	41.2	30.2	311
W-OABG	BG-138	HCS-BG-138	11/16/94	2	3	SS	1,300	NA	1,700	140,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-113	HCS-BG-113	07/13/92	2	3	SS	880	NA	880	94,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-113	HCS-BG-113S	11/15/94	0	1	SS	1,800	NA	1,800	8,000	100	85	170	57	1,900	1,331	NA	NA	NA	NA	14.8	3.1	19.9	37.2	49.8	35,200	57.6	0.48	53.3	2.7	24.5	192
W-OABG	AS01-TP14	AS01-TP14-0910	03/25/08	9	10	SB	NA	15	15	92,000	520	520	520	520	2,090	2,190	620	4,000	620	NA	9.2	0.6	14.4	19.1	42.3	25,700	36.5	0.71	29.7	0.31	16.1	125
W-OABG	AS01-TP14	AS01-DC04-0304	03/25/08	3	4	SS	NA	13	13	26,000	490	490	490	490	2,205	2,205	620	4,000	620	NA	5.1	0.31	9.4	11.6	20.6	19,600	14.5	0.062	18.9	0.18	13	61.6
W-OABG	BG-166	HCS-BG-166	10/27/98	2	3	SS	3	NA	11	92,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	AS01-SB21	AS01-SS21-(0-1)	10/25/01	0	1	SS	NA	12	12	82,000	61	55	97	390	1,605	1,082	NA	NA	NA	NA	13.1	12.4	43.3	23.7	526	33,800	1,120	4.7	47.4	70.3	44.6	1,030
E-OABG	AS01-SB72	AS01-SB72-4_5-5	09/23/04	4.5	5	SB	NA	2,800	11,000	77,000	470	470	470	470	2,115	2,115	75,000	30,000	1,800	1.85E-04	3.9	143	38.1	20.2	436	29,800	810	22.7	38.7	13.3	14.3	2,060
E-OABG	AS01-SB72	AS01-SS72-0-0_5	09/23/04	0	1	SS	NA	1,600	420	4,400	450	450	450	450	2,025	2,025	530,000	500	7,300	3.48E-04	7.2	373	319	27.7	248	54,200	814	56.3	56.0	12.3	17.8	2,060
E-OABG	AS01-SB22	AS01-SS22-(0-1)	10/25/01	0	1	SS	NA	11	11	65,000	78	79	110	380	1,580	1,049	NA	NA	NA	NA	19.3	6.5	224	34.5	1,080	57,900	337	2.5	240	61	332	1,360
E-OABG	BG-148	HCS-BG-148	11/16/94	2	3	SS	24,000	NA	160	64,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-147	HCS-BG-147	11/16/94	2	3	SS	840	NA	480	53,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-167/168	HCS-BG-167	10/27/98	2	3	SS	11	NA	11	51,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-110/110S	HCS-BG-110	07/13/92	2	3	SS	27,000	NA	820	34,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-110/110S	HCS-BG-110S	11/16/94	0	1	SS	16,000	NA	1,600	26,000	85	61	84	440	1800	805	NA	NA	NA	NA	10.2	2.3	11.9	55.2	33.7	28,700	38.5	0.1	76.1	1.1	18.8	233
W-OABG	BG-158	HCS-BG-158	10/27/98	2	3	SS	7,100	NA	11	46,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	AS01-SB74	AS01-SB74-4-4_5	09/23/04	4	5	SS	NA	15	3.3	57	460	460	460	460	2,070	2,070	100	2,500	500	6.82E-06	7	11.6	282	53.9	13,600	33,500	865	0.17	347	19.5	53.4	1,010
E-OABG	AS01-SB53	AS01-SS53-0-1	07/21/04	0	1	SS	NA	1,800	1,800	36,000	34	40	75	NA	959	317	NA	NA	NA	1.34E-04	12.5	11	63.8	20	284	28,700	1,310	1	70.5	42.6	173	1,400
W-OABG	BG-098/098S	HCS-BG-98S	11/16/94	0	1	SS	1,800	NA	1,800	27,000	110	71	99	460	1,940	923	NA	NA	NA	NA	15.8	3.5	23.6	31.2	75.5	38,600	53.3	0.46	50.8	3.3	26.2	206
E-OABG	AS01-TP28	AS01-DC09-0304	03/28/08	3	4	SS	NA	1,300	1,100	26,000	400	400	400	400	1,800	1,800	NA	NA	NA	NA	6.3	7.4	39.3	17.8	598	24,900	671	1.5	55.2	54.9	26	1,550
W-OABG	AS01-SB26	AS01-SB26-(1-2)	10/23/01	1	2	SS	NA	12	12	25,000	130	130	170	400	1,760	1,338	NA	NA	NA	NA	20.6	0.72	20.8	28	64.9	36,500	73.4	0.7	42.1	1.2	21.4	212
W-OABG	AS01-SB26	AS01-SS26-(0-1)	10/23/01	0	1	SS	NA	13	13	120	180	160	240	430	1,867	2,109	NA	NA	NA	NA	18.4	0.77	17.9	43.9	55.2	34,500	55.1	0.18	83.7	1.3	25.7	207
E-OABG	BG-102/102S	HCS-BG-102	07/13/92	1	2	SS	260	NA	1,400	25,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	BG-102/102S	HCS-BG-102S	11/16/94	0	1	SS	71	NA	29	890	100	80	120	450	1,847	980	NA	NA	NA	NA	11.4	2.9	13.1	38.6	37.3	32,600	37.1	0.14	58.8	1.5	20.1	210

Table 14
Outside Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
						COC CONCENTRATIONS	VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
						INDUSTRIAL SRGs - Surface Soil (SS):	**450**	**300**	**1,100**	**810**	**8,800**	**2,100**	**21,000**	**2,100**	**29,000**	**18,000**	**10,000**	**370**	120	9.60E-05	16.0	17.4	42.7	52.3	253	35,600	785	1.61	78.4	42.6	173	1,170
						INDUSTRIAL SRGs - Subsurface Soil (SB):	**8,400**	**N/A**	**1,100**	**810**	**8,800**	**2,100**	**21,000**	**2,100**	**N/A**	**N/A**	**N/A**	**370**	120	1.80E-04	16.0	130	**N/A**	20.9	11,000	33,000	830	39.0	**N/A**	**N/A**	**N/A**	**N/A**
W-OABG	AS01-SB25	AS01-SB25-(1-2)	10/24/01	1	2	SS	NA	11	11	11	58,000	55,000	65,000	2,100	240,060	492,100	NA	NA	NA	NA	7.3	0.64	10	16.2	27.8	16,900	21.8	0.45	25	1.9	10.4	131
W-OABG	AS01-SB25	AS01-SS25-(0-1)	10/24/01	0	1	SS	NA	12	12	12	680	750	970	390	3,453	6,205	NA	NA	NA	NA	18.2	0.93	15.4	55.6	48.2	32,300	47.6	0.28	77.3	4	22.2	246
E-OABG	BG-146	HCS-BG-146	11/16/94	2	3	SS	1,600	NA	2,200	20,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
W-OABG	BG-150	HCS-BG-150	11/15/94	2	3	SS	1,500	NA	1,500	17,000	77	74	360	360	1,580	1,301	NA	NA	NA	NA	8.3	2.1	8.8	20.2	31.3	25,200	30.4	0.22	31.3	2.1	17.3	124
W-OABG	AS01-SB39	AS01-SB39-(1-2)	10/23/01	1	2	SS	NA	12	12	16,000	310	310	360	380	2,118	2,980	NA	NA	NA	NA	21.5	0.8	23.9	28.4	72	34,200	88.6	0.79	43.1	1.2	20.7	226
W-OABG	AS01-SB39	AS01-SS39-(0-1)	10/23/01	0	1	SS	NA	13	13	180	120	110	170	380	1,530	1,286	NA	NA	NA	NA	13.1	0.78	12.3	38.3	37.5	23,100	43.3	0.12	54.5	1.3	16.1	165
E-OABG	AS01-SB30	AS01-SB30-(1-2)	10/24/01	1	2	SS	NA	12	6.1	13,000	370	330	320	390	2,314	3,165	590	59,000	590	1.22E-05	31	12.4	112	40.3	332	122,000	2,540	4.5	63.6	43.1	26.6	999
E-OABG	AS01-SB30	AS01-SS30-(0-1)	10/24/01	0	1	SS	NA	14	14	26	220	240	290	440	1,844	2,286	670	67,000	670	3.72E-06	10.5	0.82	9.5	51.1	36.2	18,900	38.1	0.14	75.4	1.4	13.4	206
E-OABG	B1-004	HCS-B1-4-S	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.4	57.1	100	39.8	780	122,000	12,100	1	107	12.6	18.1	3,860
E-OABG	AS01-TP28	AS01-TP28-0910	03/28/08	9	10	SB	NA	10	20	12,000	400	400	400	400	1,800	1,800	620	4,000	620	NA	4.6	0.35	10.5	7.7	12.5	25,000	9.5	0.12	13.4	1.2	15.3	51.8
W-OABG	AS01-TP15	AS01-TP15-0910	03/25/08	9	10	SB	NA	13	13	11,000	470	470	470	470	2,115	2,115	NA	NA	NA	NA	4.6	0.26	10.2	10.1	11.2	21,800	10	0.14	16.8	1.4	13.6	53.9
						UCL Step 1	10.8	320	71.7	1,265	917	727	1,996	230	4,031	8,958	1,500	--	126	5.13E-05	9.83	17.8	29.7	23.9	349	29,023	648	1.65	45.9	27.5	57.8	658
						Maximum - All depths	52.0	850	730	7,600	8,100	12,000	21,000	230	63,100	82,500	1,500	--	140	2.21E-04	24.9	154	110	60.0	2,150	81,100	6,680	16.8	203	121	994	4,230
						Maximum - SS	52.0	850	730	6,400	8,100	12,000	21,000	230	63,100	82,500	1,500	--	140	2.21E-04	24.9	154	103	60.0	2,150	81,100	6,680	5.30	203	121	994	3,350
						Ecological PRG	450	300	--	2,500	--	--	--	--	29,000	18,000	10,000	65,000	10,000	9.60E-05	--	17.4	42.7	--	253	--	785	1.61	78.4	42.6	173	1,170
						Maximum ratio	0.12	2.83	--	2.56	--	--	--	--	2.18	4.58	0.15	--	0.01	2.31	--	8.85	2.41	--	8.50	--	8.51	3.29	2.59	2.84	5.75	2.86
	STEP 2 (SRG Ratio >5)																															
W-OABG	AS01-TP05	AS01-DC01-0506	03/19/08	5	6	SB	NA	12	12	7,600	150	190	240	400	1,760	1,780	620	4,000	620	1.44E-04	6.2	8.2	27.2	20.3	704	27,500	178	5	46.1	104	57.2	1,440
E-OABG	B1-011	HCS-B1-11-S	07/17/92	1	2	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.2	154	103	31.6	855	45,700	6,680	2.5	74.1	24.8	30.3	2,160
E-OABG	B1-011	HCS-B1-11-2	07/17/92	0.5	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12.8	46.8	99.8	26.8	1,390	81,100	993	4.6	102	104	97.5	3,350
W-OABG	AS01-TP13	AS01-TP13-0910	03/25/08	9	10	SB	NA	12	12	6,900	470	470	470	470	2,115	2,115	620	4,000	620	NA	4.7	0.29	10	10.4	11.5	20,600	10.1	0.14	17.3	1.4	13.3	51.5
W-OABG	B2-007	HCS-B2-7-S	07/17/92	1	2	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	14.3	1.9	29.8	25.6	2,150	25,100	272	2.7	40.3	121	82.7	636
E-OABG	AS01-SB52	AS01-SS52-0-1	07/21/04	0	1	SS	NA	300	560	6,400	46	55	91	NA	1026	426	NA	NA	NA	1.20E-04	8.6	4.5	42.7	20.3	253	57,100	591	2.1	50	2.4	22.4	1,170
E-OABG	BG-149	HCS-BG-149	11/16/94	2	3	SS	1,500	NA	1,500	6,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
E-OABG	B1-C	HCS-B1-C	07/17/92	0	1	SS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.21E-04	7.3	3.3	10	5.5	81.9	10,500	4,990	2.1	11.4	8.9	5.6	291
W-OABG	AS01-TP09	AS01-DC02-0405	03/20/08	4	5	SS	NA	10	10	15	410	100	110	410	1,685	1,128	620	4,000	620	3.09E-05	7.2	8.3	36.8	13.2	69.3	23,600	179	0.12	203	1.6	994	721
W-OABG	AS01-SB57	AS01-SS57-0-1	07/21/04	0	1	SS	NA	NA	NA	NA	8,100	12,000	16,000	NA	63,100	82,500	NA	NA	NA	2.65E-05	11.2	5.2	59.5	15.8	517	30,400	939	0.44	45.5	5.5	58.3	841
W-OABG	BG-139	HCS-BG-139	11/15/94	2	3	SS	1,800	NA	1,800	4,400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
						UCL Step 2	10.3	347	43.3	471	683	506	1,628	230	2,150	4,255	1,500	--	126	3.45E-05	9.81	10.2	25.2	24.4	257	27,696	188	1.53	42.2	16.3	26.1	525
						Maximum - All depths	52.0	850	730	3,600	7,500	9,000	21,000	230	14,760	72,300	1,500	--	140	1.88E-04	24.9	84.7	110	60.0	1,970	70,900	1,630	16.8	185	106	108	4,230
						Maximum - SS	52.0	850	730	3,600	7,500	9,000	21,000	230	14,760	72,300	1,500	--	140	1.88E-04	24.9	84.7	77.7	60.0	999	70,900	1,630	5.30	94.1	95.3	108	1,400
						Ecological PRG	450	300	--	2,500	--	--	--	--	29,000	18,000	10,000	65,000	10,000	9.60E-05	--	17.4	42.7	--	253	--	785	1.61	78.4	42.6	173	1,170
						Maximum ratio	0.12	2.83	--	1.44	--	--	--	--	0.51	4.02	0.15	--	0.01	1.96	--	4.87	1.82	--	3.95	--	2.08	3.29	1.20	2.24	0.62	1.20
	STEP 3																															
W-OABG	AS01-SB34	AS01-SB34-(1-2)	10/25/01	1	2	SS	NA	12	12	23	210	190	280	390	1,570	2,116	600	60,000	600	7.28E-05	15.0	12.6	37.1	40.7	999	40,900	210	0.57	73.7	95.3	80.3	1,080
W-OABG	AS01-SB34	AS01-SS34-(0-1)	10/25/01	0	1	SS	NA	13	13	4.4	340	340	380	420	1,811	3,020	630	63,000	630	NA	16.5	0.93	15.0	60	59.8	32,300	49.7	0.41	78.9	9.8	21.4	283
W-OABG	AS01-SB48	AS01-SS48-0-1	07/20/04	0	1	SS	NA	850	610	3,600	64	81	150	NA	834	653	NA	NA	NA	NA	8.5	0.3	14.1	23.4	43.1	28,000	44.3	1	36.6	3.3	21.8	161
W-OABG	AS01-SB49	AS01-SS49-0-1	07/20/04	0	1	SS	NA	450	620	990	7,500	9,000	21,000	NA	14,760	72,300	NA	NA	NA	NA	12.4	0.069	19.7	34.6	43.5	32,300	44.9	0.36	54.5	0.54	21.8	181
						UCL Step 3	9.36	18.2	44.9	357	209	187	242	1,031	1,788	1,888	1,500	--	126	3.23E-05	9.61	10.5	25.4	23.5	247	27,360	193	1.58	41.8	14.4	25.2	526
						Maximum - All depths	52.0	320	730	2,700	1,700	1,400	1,500	230	7,136	11,530	1,500	--	140	1.88E-04	24.9	84.7	110	58.2	1,970	70,900	1,630	16.8	185	106	108	4,230
						Maximum - SS	52.0	320	730	2,700	1,700	1,400	1,500	230	7,136	11,530	1,500	--	140	1.88E-04	24.9	84.7	77.7	58.2	972	70,900	1,630	5.30	94.1	78.8	108	1,400
						Ecological PRG	450	300	--	2,500	--	--	--	--	29,000	18,000	10,000	65,000	10,000	9.60E-05	--	17.4	42.7	--	253	--	785	1.61	78.4	42.6	173	1,170
						Maximum ratio	0.12	1.07	--	1.08	--	--	--	--	0.25	0.64	0.15	--	0.01	1.96	--	4.87	1.82	--	3.84	--	2.08	3.29	1.20	1.85	0.62	1.20

Gray shaded concentrations indicate detections; NA - Not Analyzed

Notes:
µg/kg = microgram per kilogram
COC = constituent of concern
ft = foot
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification
mg/kg = milligram per kilogram
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
SRG = site remediation goal
VOC = volatile organic compound

Table 14
Outside Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

COC CONCENTRATION-to-SRG RATIOS

INDUSTRIAL SRGs - Surface Soil (SS):
INDUSTRIAL SRGs - Subsurface Soil (SB):

							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
W-OABG	22C-1	22C-1-T	10/26/95	0	1	SS															0.41	0.16	0.45		0.10	0.79	0.10	0.26	0.27	0.18	0.11	0.11
W-OABG	22C-2	22C-2-T	10/26/95	0	1	SS																	0.16			0.19	0.01					0.02
W-OABG	22D-1	22D-1-D	10/26/95	2	4	SS															0.41	0.06	0.32	0.25	0.09	0.76	0.03	0.34	0.22		0.12	0.08
W-OABG	22D-1	22D-1-T	10/26/95	0	1	SS															0.27	0.11	0.52		0.13	0.35	0.10	3.29	0.11	0.27	0.09	0.22
W-OABG	AOCM-1	AOCM-1-T	10/26/01	0	1	SS					0.02		0.01		0.06	0.07					1.04		0.37	0.82	0.18	0.88	0.07	0.21	0.78	0.06	0.21	0.19
W-OABG	AOCM-2	AOCM-2-T	10/26/01	0	1	SS					0.01		0.00		0.06	0.05					0.60		0.30	0.46	0.13	0.58	0.06	0.19	0.49	0.05	0.24	0.12
E-OABG	AS01-SB21	AS01-SS21-(0-1)	10/25/01	0	1	SS				101	0.01	0.03	0.00		0.06	0.06					0.82	0.71	1.01	0.45	2.08	0.95	1.43	2.92	0.60	1.65	0.26	0.88
E-OABG	AS01-SB22	AS01-SS22-(0-1)	10/25/01	0	1	SS				80.2	0.01	0.04	0.01		0.05	0.06					1.21	0.37	5.25	0.66	4.27	1.63	0.43	1.55	3.06	1.43	1.92	1.16
W-OABG	AS01-SB23	AS01-SS23-(0-1)	10/26/01	0	1	SS					0.01		0.01		0.06	0.06					0.64		0.53	0.36	0.23	0.69	0.06	0.15	0.37	0.28	0.14	0.20
W-OABG	AS01-SB24	AS01-SB24-(1-2)	10/24/01	1	2	SS									0.04						0.74		0.29	0.46	0.20	0.59	0.08	0.16	0.43		0.07	0.13
W-OABG	AS01-SB24	AS01-SS24-(0-1)	10/24/01	0	1	SS					0.09	0.32	0.04	0.02	0.13	0.35					0.90	0.04	0.27	1.11	0.16	0.72	0.05	0.18	1.01	0.04	0.10	0.20
W-OABG	AS01-SB25	AS01-SB25-(1-2)	10/24/01	1	2	SS					6.59	26.2	3.10	1.00	8.28	27.3					0.46		0.23	0.31	0.11	0.47	0.03	0.28	0.32	0.04	0.06	0.11
W-OABG	AS01-SB25	AS01-SS25-(0-1)	10/24/01	0	1	SS					0.08	0.36	0.05		0.12	0.34					1.14	0.05	0.36	1.06	0.19	0.91	0.06	0.17	0.99	0.09	0.13	0.21
W-OABG	AS01-SB26	AS01-SB26-(1-2)	10/23/01	1	2	SS				30.9	0.01	0.06	0.01		0.06	0.07					1.29		0.49	0.54	0.26	1.03	0.09	0.43	0.54		0.12	0.18
W-OABG	AS01-SB26	AS01-SS26-(0-1)	10/23/01	0	1	SS				0.15	0.02	0.08	0.01	0.20	0.06	0.12					1.15		0.42	0.84	0.22	0.97	0.07	0.11	1.07		0.15	0.18
W-OABG	AS01-SB27	AS01-SB27-(1-2)	10/23/01	1	2	SS					0.02	0.09	0.02		0.05	0.11					0.92		0.39	0.39	0.15	0.88	0.05	0.22	0.37		0.11	0.11
W-OABG	AS01-SB27	AS01-SS27-(0-1)	10/23/01	0	1	SS				0.02	0.02	0.08	0.01		0.06	0.10					0.69		0.27	0.74	0.16	0.62	0.06	0.09	0.71		0.09	0.14
W-OABG	AS01-SB28	AS01-SS28-(0-1)	10/26/01	0	1	SS				0.01	0.01		0.01		0.06	0.05					0.81		0.30	0.80	0.15	0.75	0.05	0.43	0.76		0.11	0.15
E-OABG	AS01-SB29	AS01-SS29-(0-1)	10/26/01	0	1	SS				0.02	0.01		0.00		0.06	0.07					0.90		0.31	0.76	0.14	0.75	0.06	0.10	0.69		0.13	0.14
E-OABG	AS01-SB30	AS01-SB30-(1-2)	10/24/01	1	2	SS			0.01	16.0	0.04	0.16	0.02		0.08	0.18				0.13	1.94	0.71	2.62	0.77	1.31	3.43	3.24	2.80	0.81	1.01	0.15	0.85
E-OABG	AS01-SB30	AS01-SS30-(0-1)	10/24/01	0	1	SS				0.03	0.03	0.11	0.01		0.06	0.13				0.04	0.66		0.22	0.98	0.14	0.53	0.05		0.96		0.08	0.18
W-OABG	AS01-SB33	AS01-SS33-(0-1)	10/26/01	0	1	SS					0.03		0.01		0.07	0.11				0.14	1.12		0.36	0.80	0.18	0.94	0.05	0.11	0.74	0.04	0.12	0.16
W-OABG	AS01-SB34	AS01-SB34-(1-2)	10/25/01	1	2	SS				0.03	0.02	0.09	0.01		0.05	0.12				0.76	0.94	0.72	0.87	0.78	3.95	1.15	0.27	0.35	0.94	2.24	0.46	0.92
W-OABG	AS01-SB34	AS01-SS34-(0-1)	10/25/01	0	1	SS				0.01	0.04	0.16	0.02		0.06	0.17					1.03	0.05	0.35	1.15	0.24	0.91	0.06	0.25	1.01	0.23	0.12	0.24
W-OABG	AS01-SB35	AS01-SS35-(0-1)	10/26/01	0	1	SS					0.02		0.01		0.05	0.08				0.06	0.86		0.30	0.75	0.15	0.78	0.06	0.11	0.70	0.04	0.11	0.16
W-OABG	AS01-SB36	AS01-SB36-(1-2)	10/25/01	1	2	SS					0.01	0.03	0.00		0.05	0.05				0.15	0.63	0.07	0.29	0.30	0.18	0.69	0.06	0.09	0.29	0.14	0.08	0.19
W-OABG	AS01-SB36	AS01-SS36-(0-1)	10/25/01	0	1	SS					0.01	0.05	0.01		0.05	0.07				0.18	1.12		0.39	0.78	0.18	0.98	0.06	0.11	0.72		0.13	0.17
W-OABG	AS01-SB37	AS01-SS37-(0-1)	10/26/01	0	1	SS					0.02		0.01		0.06	0.08				0.24	0.81	0.04	0.48	0.56	0.64	0.70	0.13	0.17	0.60	0.07	0.19	0.31
W-OABG	AS01-SB38	AS01-SB38-(1-2)	10/26/01	1	2	SS					0.02	0.08	0.01		0.05	0.08				0.01	0.67		0.33	0.29	0.09	0.79	0.04		0.24		0.11	0.07
W-OABG	AS01-SB38	AS01-SS38-(0-1)	10/26/01	0	1	SS					0.02	0.07	0.01		0.06	0.08				0.19	0.57		0.32	0.41	0.11	0.58	0.05		0.41		0.13	0.09
W-OABG	AS01-SB39	AS01-SB39-(1-2)	10/23/01	1	2	SS				19.8	0.04	0.15	0.02		0.07	0.17					1.34	0.05	0.56	0.54	0.28	0.96	0.11	0.49	0.55		0.12	0.19
W-OABG	AS01-SB39	AS01-SS39-(0-1)	10/23/01	0	1	SS				0.22	0.01	0.05	0.01		0.05	0.07					0.82		0.29	0.73	0.15	0.65	0.06		0.70		0.09	0.14
E-OABG	AS01-SB40	AS01-SB40-(1-2)	10/24/01	1	2	SS			0.01	0.02	0.03	0.15	0.02		0.08	0.18				0.06	0.63		0.31	0.37	0.13	0.59	0.07	0.22	0.32		0.08	0.09
E-OABG	AS01-SB40	AS01-SS40-(0-1)	10/24/01	0	1	SS				0.03	0.02	0.07	0.01		0.05	0.08				0.56	1.56	4.87	0.70	0.82	3.84	1.99	0.53	0.11	1.01		0.17	1.20
E-OABG	AS01-SB41	AS01-SB41-(1-2)	10/24/01	1	2	SS				0.04	0.03	0.10	0.01		0.06	0.11				0.01	0.89		0.28	0.40	0.15	0.75	0.06	0.16	0.39		0.09	0.14
E-OABG	AS01-SB41	AS01-SS41-(0-1)	10/24/01	0	1	SS					0.02	0.09	0.01		0.05	0.10				0.11	1.02	0.05	0.33	0.84	0.17	0.83	0.07	0.11	0.81		0.13	0.16
W-OABG	AS01-SB46	AS01-SS46-0-1	07/20/04	0	1	SS		0.01			0.01	0.04	0.01		0.03	0.04					0.69		0.33	0.89	0.15	0.83	0.05	0.11	0.82		0.11	0.16
W-OABG	AS01-SB47	AS01-SS47-0-1	07/20/04	0	1	SS					0.01	0.07	0.01		0.02	0.06					0.74		0.37	0.80	0.18	0.88	0.06	0.60	0.77	0.07	0.12	0.19
W-OABG	AS01-SB48	AS01-SS48-0-1	07/20/04	0	1	SS		2.83		4.44	0.01	0.04	0.01		0.03	0.04					0.53		0.33	0.45	0.17	0.79	0.06	0.62	0.47	0.08	0.13	0.14
W-OABG	AS01-SB49	AS01-SS49-0-1	07/20/04	0	1	SS		1.50		1.22	0.85	4.29	1.00		0.51	4.02					0.78		0.46	0.66	0.17	0.91	0.06	0.22	0.70		0.13	0.15
E-OABG	AS01-SB50	AS01-SS50-0-1	07/21/04	0	1	SS		0.04			0.00	0.01	0.00		0.03	0.01				0.03	0.37		0.24	0.20	0.07	0.59	0.09	0.06	0.20		0.09	0.05
E-OABG	AS01-SB51	AS01-SS51-0-1	07/21/04	0	1	SS		1.07	0.66	3.33	0.00	0.02	0.00		0.03	0.02				0.44	0.53	0.75	0.55	0.46	0.49	0.87	0.28	0.16	0.47		0.15	0.72
E-OABG	AS01-SB52	AS01-SS52-0-1	07/21/04	0	1	SS		1.00	0.51	7.90	0.01	0.03	0.00		0.04	0.02				1.25	0.54	0.26	1.00	0.39	1.00	1.60	0.75	1.30	0.64	0.06	0.13	1.00
E-OABG	AS01-SB53	AS01-SS53-0-1	07/21/04	0	1	SS				44.4	0.00	0.02	0.00		0.03	0.02				1.40	0.78	0.63	1.49	0.38	1.12	0.81	1.67	0.62	0.90	1.00	1.00	1.20
E-OABG	AS01-SB54	AS01-SS54-0-1	07/21/04	0	1	SS					0.01	0.06	0.01		0.03	0.05				0.19	0.80		0.40	0.71	0.17	0.91	0.06	0.19	0.72		0.15	0.15
W-OABG	AS01-SB56	AS01-SS56-0-1	07/21/04	0	1	SS					0.01	0.05	0.01		0.03	0.05				0.17	0.74		0.37	0.82	0.16	0.89	0.05	0.16	0.76		0.13	0.17
W-OABG	AS01-SB57	AS01-SS57-0-1	07/21/04	0	1	SS					0.92	5.71	0.76		2.18	4.58				0.28	0.70	0.30	1.39	0.30	2.04	0.85	1.20	0.27	0.58	0.13	0.34	0.72
E-OABG	AS01-SB58	AS01-SS58-0-1	07/21/04	0	1	SS					0.01	0.04	0.01		0.03	0.04				0.46	0.70		0.33	0.76	0.16	0.81	0.06	0.14	0.73		0.13	0.15
E-OABG	AS01-SB59	AS01-SS59-0-1	07/21/04	0	1	SS					0.01	0.05	0.01		0.03	0.05				0.12	0.79		0.38	0.80	0.17	0.91	0.06	0.15	0.80		0.14	0.15
E-OABG	AS01-SB71	AS01-SB71-1_5-2	09/23/04	1.5	2	SS			0.02	0.02			0.00		0.06	0.09	0.15		1.17	0.02	0.44	0.03	0.33	0.26	0.09	0.66	0.05	0.17	0.27	0.02	0.08	0.07
E-OABG	AS01-SB71	AS01-SS71-0-0_5	09/23/04	0	1	SS									0.07		0.05		0.68	0.05	0.59	0.10	0.35	0.52	0.14	0.81	0.08	0.14	0.55	0.02	0.14	0.15
E-OABG	AS01-SB72	AS01-SB72-4_5-5	09/23/04	4.5	5	SB			10.0	95.1								81.1	15.0	1.03	0.24	1.10		0.97	0.04	0.90	0.98	0.58				
E-OABG	AS01-SB72	AS01-SS72-0-0_5	09/23/04	0	1	SS		5.33	0.38	5.43							53.0	1.35	60.8	3.63	0.45	21.4	7.47	0.53	0.98	1.52	1.04	35.0	0.71	0.29	0.10	1.76
E-OABG	AS01-SB73	AS01-SB73-1_5-2	09/23/04	1.5	2	SS				210							0.01			0.02	0.44		0.30	0.29	0.09	0.78	0.03	0.11	0.29	0.01	0.10	0.07
E-OABG	AS01-SB73	AS01-SS73-0-0_5	09/23/04	0	1	SS				27.2							0.01			0.25	0.54	0.12	0.88	0.31	0.68	1.14	0.14	0.26	0.47	0.97	0.17	0.27
E-OABG	AS01-SB74	AS01-SB74-4-4_5	09/23/04	4	5	SS			0.00	0.07							0.01			0.07	0.44	0.67	6.60	1.03	53.8	0.94	1.10	0.11	4.43	0.46	0.31	0.86
E-OABG	AS01-SB74	AS01-SS74-0-0_5	09/23/04	0	1	SS				0.01					0.06					0.07	0.47	0.04	0.73	0.35	0.38	0.89	0.09	0.21	0.37	0.02	0.11	0.16
W-OABG	AS01-TP02	AS01-TP02-0910	03/18/08	9	10	SB														0.00	0.41	0.00		0.32	0.00	1.00	0.01					
W-OABG	AS01-TP03	AS01-TP03-0910	03/18/08	9	10	SB														0.00	0.31	0.00		0.56	0.00	0.73	0.01					
W-OABG	AS01-TP04	AS01-TP04-0910	03/18/08	9	10	SB														0.00	0.25	0.00		0.33	0.00	0.60	0.01					
W-OABG	AS01-TP05	AS01-DC01-0506	03/19/08	5	6	SB				9.38	0.02	0.09	0.01							0.80	0.39	0.06		0.97	0.06	0.83	0.21	0.13				
W-OABG	AS01-TP05	AS01-TP05-0910	03/19/08	9	10	SB				0.04	0.02	0.07	0.01							0.42	0.42	0.05		0.81	0.03	0.87	0.18	0.07				
W-OABG	AS01-TP06	AS01-TP06-0910	03/19/08	9	10	SB				0.05										0.00	0.29	0.00		0.18	0.00	0.82	0.01					
W-OABG	AS01-TP07	AS01-DC03-0304	03/20/08	3	4	SS									0.06	0.10				0.16	0.49	0.06	0.65	0.26	2.23	0.94	0.13	0.03	0.36	0.03	0.11	0.79
W-OABG	AS01-TP07	AS01-TP07-0910	03/20/08	9	10	SB														0.00	0.35	0.00		0.33	0.00	0.78	0.01	0.00				
W-OABG	AS01-TP08	AS01-TP08-0910	03/20/08	9	10	SB														0.00	0.27	0.00		0.41	0.00	0.63	0.01					
W-OABG	AS01-TP09	AS01-DC02-0405	03/20/08	4	5	SS				0.02		0.05	0.01		0.06	0.06				0.32	0.45	0.48	0.86	0.25	0.27	0.66	0.23		2.59	0.04	5.75	0.62
W-OABG	AS01-TP09	AS01-TP09-0910	03/20/08	9	10	SB				0.03										0.00	0.31	0.00		0.63	0.00	0.75	0.01					
W-OABG	AS01-TP10	AS01-TP10-0910	03/24/08	9	10	SB				0.10											0.31	0.00		0.59	0.00	0.80	0.01					
W-OABG	AS01-TP11	AS01-TP11-0910	03/24/08	9	10	SB				0.03											0.44	0.00		0.68	0.00	0.67	0.04					
W-OABG	AS01-TP12	AS01-TP12-0809	03/25/08	8	9	SB				0.19											0.37	0.00		0.48	0.00	0.81	0.01					
W-OABG	AS01-TP13	AS01-TP13-0910	03/25/08	9	10	SB				8.52											0.29	0.00		0.50	0.00	0.62	0.01					

Table 14
Outside Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

INDUSTRIAL SRGs - Surface Soil (SS):
INDUSTRIAL SRGs - Subsurface Soil (SB):

COC CONCENTRATION-to-SRG RATIOS

							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
W-OABG	AS01-TP14	AS01-DC04-0304	03/25/08	3	4	SS				32.1											0.32	0.02	0.22	0.22	0.08	0.55	0.02		0.24	0.00	0.08	0.05
W-OABG	AS01-TP14	AS01-TP14-0910	03/25/08	9	10	SB				114											0.58	0.00		0.91	0.00	0.78	0.04	0.02				
W-OABG	AS01-TP15	AS01-TP15-0910	03/25/08	9	10	SB				13.6											0.29	0.00		0.48	0.00	0.66	0.01					
C-OABG	AS01-TP16	AS01-TP16-0809	03/25/08	8	9	SB				0.08										0.05	0.70	0.01		1.25	0.00	0.97	0.05	0.01				
C-OABG	AS01-TP17	AS01-TP17-0809	03/25/08	8	9	SB														0.26	0.63	0.01		1.10	0.00	0.90	0.04					
C-OABG	AS01-TP18	AS01-TP18-0910	03/26/08	9	10	SB															0.29	0.00		0.44	0.00	0.63	0.01					
C-OABG	AS01-TP19	AS01-TP19-0910	03/26/08	9	10	SB				0.01											0.24	0.00		0.41	0.00	0.53	0.01					
C-OABG	AS01-TP20	AS01-TP20-0910	03/26/08	9	10	SB															0.24	0.00		0.38	0.00	0.58	0.01					
C-OABG	AS01-TP21	AS01-TP21-0910	03/26/08	9	10	SB				0.01											0.23	0.00		0.37	0.00	0.52	0.01					
C-OABG	AS01-TP22	AS01-TP22-0910	03/26/08	9	10	SB				0.04										0.00	0.29	0.00		0.43	0.00	0.65	0.01					
E-OABG	AS01-TP23	AS01-DC12-0102	03/31/08	1	2	SS						0.07				0.09					0.37	0.03	0.24	0.18	0.09	0.54	0.12	0.11	0.21	0.02	0.09	0.07
E-OABG	AS01-TP23	AS01-TP23-0910	03/31/08	9	10	SB				0.00											0.28	0.00		0.40	0.00	0.65	0.01	0.00				
E-OABG	AS01-TP24	AS01-TP24-0910	03/27/08	9	10	SB				0.01										0.00	0.28	0.00		0.44	0.00	0.65	0.01					
E-OABG	AS01-TP25	AS01-DC13-0304	04/01/08	3	4	SS				0.01										0.00	0.51	0.11	0.74	0.22	0.12	0.72	0.06	0.19	1.20	0.02	0.12	0.22
E-OABG	AS01-TP25	AS01-TP25-0910	04/01/08	9	10	SB			0.00	0.02										0.00	0.33	0.00		0.44	0.00	0.74	0.04					
E-OABG	AS01-TP26	AS01-TP26-0910	03/31/08	9	10	SB			0.03	0.04											0.24	0.00		0.42	0.00	0.56	0.01	0.00				
E-OABG	AS01-TP27	AS01-DC10-0405	03/28/08	4	5	SS			0.02	0.11											0.39	0.08	0.35	0.24	0.18	0.66	0.21	0.28	0.41	0.05	0.09	0.21
E-OABG	AS01-TP27	AS01-TP27-0910	03/28/08	9	10	SB			0.02	0.08											0.31	0.01		0.49	0.00	0.70	0.01					
E-OABG	AS01-TP28	AS01-DC09-0304	03/28/08	3	4	SS			1.00	32.1											0.39	0.43	0.92	0.34	2.36	0.70	0.85	0.93	0.70	1.29	0.15	1.32
E-OABG	AS01-TP28	AS01-TP28-0910	03/28/08	9	10	SB			0.02	14.8											0.29	0.00		0.37	0.00	0.76	0.01					
E-OABG	AS01-TP29	AS01-DC08-0304	03/28/08	3	4	SS				86.4										0.01	0.38	0.06	0.28	0.20	0.09	0.72	0.03	3.04	0.25	0.10	0.10	0.24
E-OABG	AS01-TP29	AS01-TP29-0910	03/28/08	9	10	SB				568											0.29	0.00		0.26	0.00	0.70	0.01					
E-OABG	AS01-TP30	AS01-DC05-0203	03/27/08	2	3	SS				0.01					0.06	0.09					0.59	0.48	1.82	0.49	3.08	0.87	0.25	1.24	0.97	0.11	0.11	0.72
E-OABG	AS01-TP30	AS01-TP30-0910	03/27/08	9	10	SB				0.00	0.01	0.05	0.01								0.38	0.01		1.09	0.04	0.60	0.04					
W-OABG	AS01-TP32	AS01-TP32-0910	03/24/08	9	10	SB				0.04	0.02	0.06	0.01								0.65	0.00		1.00	0.00	0.87	0.06					
W-OABG	AS01-TP33	AS01-TP33-0607	03/25/08	6	7	SB				0.21											0.31	0.00		0.47	0.00	0.62	0.01					
C-OABG	AS01-TP34	AS01-TP34-0910	03/26/08	9	10	SB				0.01											0.21	0.00		0.33	0.00	0.48	0.01					
E-OABG	AS01-TP35	AS01-DC11-0203	03/31/08	2	3	SS															0.29	0.02	0.25	0.19	0.07	0.62	0.06	0.07	0.19	0.03	0.09	0.06
E-OABG	AS01-TP35	AS01-TP35-0910	03/31/08	9	10	SB				0.01											0.29	0.01		0.53	0.00	0.68	0.01	0.00				
E-OABG	AS01-TP36	AS01-DC07-0304	03/27/08	3	4	SS			0.00	284											0.28	0.02	0.18	0.21	0.06	0.46	0.02		0.20	0.00	0.06	0.04
E-OABG	AS01-TP36	AS01-TP36-0910	03/27/08	9	10	SB			0.00	901										0.04	0.26	0.00		0.39	0.00	0.54	0.01					
E-OABG	AS01-TP37	AS01-DC06-0203	03/27/08	2	3	SS				0.02	0.01		0.01		0.07	0.08					0.63	0.05	0.37	0.38	0.21	0.71	0.07	0.42	0.41	0.09	0.09	0.17
E-OABG	AS01-TP37	AS01-TP37-0910	03/27/08	9	10	SB				0.02											0.48	0.01		0.61	0.00	0.60	0.08	0.01				
E-OABG	AS01-TP38	AS01-TP38-0910	03/27/08	9	10	SB				0.01											0.33	0.00		1.81	0.00	0.64	0.02					
E-OABG	B1-003	HCS-B1-3-1	07/17/92	1	2	SS															0.28	0.20	1.10	0.28	0.32	0.80	0.22	0.17	0.33	0.03	0.10	0.33
E-OABG	B1-003	HCS-B1-3-S	07/17/92	0.5	1	SS															0.90	1.32	1.20	0.54	1.22	0.76	1.01	0.35	0.56	0.14	0.20	1.10
E-OABG	B1-004	HCS-B1-4-S	07/17/92	0.5	1	SS															0.53	3.28	2.34	0.76	3.08	3.43	15.4	0.62	1.36	0.30	0.10	3.30
E-OABG	B1-011	HCS-B1-11-2	07/17/92	0.5	1	SS															0.80	2.69	2.34	0.51	5.49	2.28	1.26	2.86	1.30	2.44	0.56	2.86
E-OABG	B1-011	HCS-B1-11-S	07/17/92	1	2	SS															0.89	8.85	2.41	0.60	3.38	1.28	8.51	1.55	0.95	0.58	0.18	1.85
E-OABG	B1-12S/12	HCS-B1-12-1	11/16/94	0	1	SS																										
E-OABG	B1-12S/12	HCS-B1-12-S	11/16/94	0	1	SS					0.01		0.00		0.07	0.09																
E-OABG	B1-13S/13	HCS-B1-13-1	11/16/94	0	1	SS					0.01	0.03	0.00		0.05	0.04																
E-OABG	B1-13S/13	HCS-B1-13-S	11/16/94	0	1	SS																										
E-OABG	B1-C	HCS-B1-C	07/17/92	0	1	SS														2.31	0.46	0.19	0.23	0.11	0.32	0.29	6.36	1.30	0.15	0.21	0.03	0.25
E-OABG	B1-CS	HCS-B1-CS	06/20/94	1	2	SS																										
W-OABG	B2-003	HCS-B2-3-4	07/17/92	3	4	SS															0.48		0.74	0.40	0.54	0.80	0.09	0.20	0.70	0.15	0.62	0.35
W-OABG	B2-003	HCS-B2-3-S	07/17/92	2	3	SS															0.59	0.30	1.29	0.47	2.29	0.90	2.08	0.75	0.63	1.85	0.19	0.58
W-OABG	B2-004	HCS-B2-4-4	07/17/92	3	4	SS					0.19	0.67	0.07	0.11	0.25	0.64																
W-OABG	B2-005	HCS-B2-5-3	07/17/92	2	3	SS					0.08	0.33	0.03		0.10	0.31																
W-OABG	B2-006	HCS-B2-6-3	07/17/92	2	3	SS					0.01	0.04	0.00		0.07	0.06																
W-OABG	B2-007	HCS-B2-7-3	07/17/92	2	3	SS															0.43		0.36	0.36	0.22	0.85	0.10	0.25	0.48	0.05	0.08	0.14
W-OABG	B2-007	HCS-B2-7-S	07/17/92	1	2	SS															0.89	0.11	0.70	0.49	8.50	0.71	0.35	1.68	0.51	2.84	0.48	0.54
W-OABG	B2-010	HCS-B2-10	07/17/92	5	6	SB															0.69	0.29		1.46	0.18	0.95	0.57	0.43				
W-OABG	B2-C	HCS-B2-C	07/17/92	0.5	1	SS														1.96	0.81	0.39	0.80	0.49	1.38	0.90	0.25	1.99	0.85	1.51	0.44	0.73
E-OABG	BG-003	HCS-BG-3	07/13/92	3	4	SS				0.01																						
W-OABG	BG-015	HCS-BG-15	07/13/92	3	4	SS				0.03																						
E-OABG	BG-023/023S/083	HCS-BG-23S	06/21/94	0	1	SS																										
E-OABG	BG-084/084S/106	HCS-BG-106	07/13/92	11	12	SB				3.09																						
E-OABG	BG-084/084S/106	HCS-BG-84	07/13/92	3	4	SS				0.12																						
E-OABG	BG-084/084S/106	HCS-BG-84S	06/20/94	0	1	SS				0.14																						
W-OABG	BG-098/098S	HCS-BG-98S	11/16/94	0	1	SS				33.3	0.01	0.03	0.00		0.07	0.05					0.99		0.55	0.60	0.30	1.08	0.07	0.29	0.65	0.08	0.15	0.18
W-OABG	BG-099	HCS-BG-99	07/13/92	2	3	SS				0.01																						
W-OABG	BG-099	HCS-BG-99R	07/13/92	2	3	SS				0.01																						
E-OABG	BG-102/102S	HCS-BG-102	07/13/92	1	2	SS	0.58		1.27	30.9																						
E-OABG	BG-102/102S	HCS-BG-102S	11/16/94	0	1	SS			0.03	1.10	0.01	0.04	0.01		0.06	0.05					0.71		0.31	0.74	0.15	0.92	0.05	0.09	0.75		0.12	0.18
E-OABG	BG-110/110S	HCS-BG-110	07/13/92	2	3	SS	60.0			42.0																						
E-OABG	BG-110/110S	HCS-BG-110S	11/16/94	0	1	SS	35.6			32.1	0.01	0.03	0.00		0.06	0.04					0.64		0.28	1.06	0.13	0.81	0.05	0.06	0.97		0.11	0.20
W-OABG	BG-112	HCS-BG-112	07/13/92	2	3	SS	0.07			0.07																						
W-OABG	BG-112	HCS-BG-112R	07/13/92	2	3	SS				0.02																						
W-OABG	BG-113	HCS-BG-113	07/13/92	2	3	SS				116																						
W-OABG	BG-113	HCS-BG-113S	11/15/94	0	1	SS				9.88	0.01	0.04	0.01	0.03	0.07	0.07					0.93	0.18	0.47	0.71	0.20	0.99	0.07	0.30	0.68	0.06	0.14	0.16
W-OABG	BG-134	HCS-BG-134	11/16/94	2	3	SS	5.11			284																						

Table 14
Outside Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

COC CONCENTRATION-to-SRG RATIOS

							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
					INDUSTRIAL SRGs - Surface Soil (SS):																											
					INDUSTRIAL SRGs - Subsurface Soil (SB):																											
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
W-OABG	BG-135	HCS-BG-135	11/16/94	2	3	SS			0.00	0.09																						
W-OABG	BG-136	HCS-BG-136	11/16/94	2	3	SS	0.02			0.90																						
W-OABG	BG-137	HCS-BG-137	11/16/94	2	3	SS				0.01																						
W-OABG	BG-138	HCS-BG-138	11/16/94	2	3	SS	2.89			173																						
W-OABG	BG-139	HCS-BG-139	11/15/94	2	3	SS				5.43																						
W-OABG	BG-140	HCS-BG-140	11/15/94	2	3	SS	0.00			0.05																						
W-OABG	BG-141	HCS-BG-141	11/16/94	2	3	SS				0.01																						
W-OABG	BG-142	HCS-BG-142	11/16/94	2	3	SS	0.03			0.20																						
E-OABG	BG-143	HCS-BG-143	11/16/94	2	3	SS				0.02																						
E-OABG	BG-144	HCS-BG-144	11/16/94	2	3	SS				0.03																						
E-OABG	BG-145	HCS-BG-145	11/16/94	2	3	SS	0.00			0.01																						
E-OABG	BG-146	HCS-BG-146	11/16/94	2	3	SS			2.00	24.7																						
E-OABG	BG-147	HCS-BG-147	11/16/94	2	3	SS	1.87		0.44	65.4																						
E-OABG	BG-148	HCS-BG-148	11/16/94	2	3	SS	53.3		0.15	79.0																						
E-OABG	BG-149	HCS-BG-149	11/16/94	2	3	SS				7.90																						
W-OABG	BG-150	HCS-BG-150	11/15/94	2	3	SS				21.0	0.01	0.04			0.05	0.07					0.52		0.21	0.39	0.12	0.71	0.04	0.14	0.40	0.05	0.10	0.11
W-OABG	BG-151	HCS-BG-151	03/04/95	2	3	SS			0.00																							
W-OABG	BG-154	HCS-BG-154	10/27/98	2	3	SS																										
W-OABG	BG-155	HCS-BG-155	10/27/98	2	3	SS																										
W-OABG	BG-156	HCS-BG-156	10/27/98	2	3	SS	0.12			1.11																						
W-OABG	BG-157	HCS-BG-157	10/27/98	2	3	SS																										
W-OABG	BG-158	HCS-BG-158	10/27/98	2	3	SS	15.8			56.8																						
W-OABG	BG-159/160	HCS-BG-159	10/27/98	2	3	SS				0.03																						
W-OABG	BG-159/160	HCS-BG-160	10/27/98	4	6	SB				0.07																						
W-OABG	BG-163/164	HCS-BG-163	10/27/98	2	3	SS				0.03																						
W-OABG	BG-163/164	HCS-BG-164	10/27/98	4	6	SB				0.00																						
W-OABG	BG-166	HCS-BG-166	10/27/98	2	3	SS	0.01			114																						
W-OABG	BG-167/168	HCS-BG-167	10/27/98	2	3	SS				63.0																						
W-OABG	BG-167/168	HCS-BG-168	10/27/98	4	6	SB	0.00			0.89																						
E-OABG	BG-169	HCS-BG-169	10/27/98	2	3	SS																										
E-OABG	BG-170	HCS-BG-170	10/27/98	2	3	SS				0.01																						
E-OABG	BG-172	HCS-BG-172	10/27/98	2	3	SS			0.04	0.86																						
E-OABG	BG-173	HCS-BG-173	10/27/98	2	3	SS			0.00	0.48																						
E-OABG	BG-174	HCS-BG-174	10/27/98	2	3	SS	0.01			444																						
E-OABG	BG-175/176	HCS-BG-175	10/27/98	2	3	SS				0.12																						
E-OABG	BG-175/176	HCS-BG-176	10/27/98	4	6	SB				0.65																						
E-OABG	BG-177/178	HCS-BG-177	10/27/98	2	3	SS				0.05																						
E-OABG	BG-177/178	HCS-BG-178	10/27/98	4	6	SB				0.20																						
					UCL Current Conditions																											
	STEP 1 (SRG Ratio >10)																															
E-OABG	AS01-TP36	AS01-TP36-0910	03/27/08	9	10	SB			0.00	901										0.04	0.26	0.00		0.39	0.00	0.54	0.01					
E-OABG	AS01-TP36	AS01-DC07-0304	03/27/08	3	4	SS			0.00	284											0.28	0.02	0.18	0.21	0.06	0.46	0.02		0.20	0.00	0.06	0.04
E-OABG	AS01-TP29	AS01-TP29-0910	03/28/08	9	10	SB				568											0.29	0.00		0.26	0.00	0.70	0.01					
E-OABG	AS01-TP29	AS01-DC08-0304	03/28/08	3	4	SS				86.4										0.01	0.38	0.06	0.28	0.20	0.09	0.72	0.03	3.04	0.25	0.10	0.10	0.24
E-OABG	BG-174	HCS-BG-174	10/27/98	2	3	SS	0.01			444																						
W-OABG	BG-134	HCS-BG-134	11/16/94	2	3	SS	5.11			284																						
E-OABG	AS01-SB73	AS01-SB73-1_5-2	09/23/04	1.5	2	SS				210							0.01			0.02	0.44		0.30	0.29	0.09	0.78	0.03	0.11	0.29	0.01	0.10	0.07
E-OABG	AS01-SB73	AS01-SS73-0-0_5	09/23/04	0	1	SS				27.2							0.01			0.25	0.54	0.12	0.88	0.31	0.68	1.14	0.14	0.26	0.47	0.97	0.17	0.27
W-OABG	BG-138	HCS-BG-138	11/16/94	2	3	SS	2.89			173																						
W-OABG	BG-113	HCS-BG-113	07/13/92	2	3	SS				116																						
W-OABG	BG-113	HCS-BG-113S	11/15/94	0	1	SS				9.88	0.01	0.04	0.01	0.03	0.07	0.07					0.93	0.18	0.47	0.71	0.20	0.99	0.07	0.30	0.68	0.06	0.14	0.16
W-OABG	AS01-TP14	AS01-TP14-0910	03/25/08	9	10	SB				114											0.58	0.00		0.91	0.00	0.78	0.04	0.02				
W-OABG	AS01-TP14	AS01-DC04-0304	03/25/08	3	4	SS				32.1											0.32	0.02	0.22	0.22	0.08	0.55	0.02		0.24	0.00	0.08	0.05
W-OABG	BG-166	HCS-BG-166	10/27/98	2	3	SS	0.01			114																						
E-OABG	AS01-SB21	AS01-SS21-(0-1)	10/25/01	0	1	SS				101	0.01	0.03	0.00		0.06	0.06					0.82	0.71	1.01	0.45	2.08	0.95	1.43	2.92	0.60	1.65	0.26	0.88
E-OABG	AS01-SB72	AS01-SB72-4_5-5	09/23/04	4.5	5	SB			10.0	95.1								81.1	15.0	1.03	0.24	1.10		0.97	0.04	0.90	0.98	0.58				
E-OABG	AS01-SB72	AS01-SS72-0-0_5	09/23/04	0	1	SS		5.33	0.38	5.43							53.0	1.35	60.8	3.63	0.45	21.4	7.47	0.53	0.98	1.52	1.04	35.0	0.71	0.29	0.10	1.76
E-OABG	AS01-SB22	AS01-SS22-(0-1)	10/25/01	0	1	SS				80.2	0.01	0.04	0.01		0.05	0.06					1.21	0.37	5.25	0.66	4.27	1.63	0.43	1.55	3.06	1.43	1.92	1.16
E-OABG	BG-148	HCS-BG-148	11/16/94	2	3	SS	53.3		0.15	79.0																						
E-OABG	BG-147	HCS-BG-147	11/16/94	2	3	SS	1.87		0.44	65.4																						
W-OABG	BG-167/168	HCS-BG-167	10/27/98	2	3	SS				63.0																						
E-OABG	BG-110/110S	HCS-BG-110	07/13/92	2	3	SS	60.0			42.0																						
E-OABG	BG-110/110S	HCS-BG-110S	11/16/94	0	1	SS	35.6			32.1	0.01	0.03	0.00		0.06	0.04					0.64		0.28	1.06	0.13	0.81	0.05	0.06	0.97		0.11	0.20
W-OABG	BG-158	HCS-BG-158	10/27/98	2	3	SS	15.8			56.8																						
E-OABG	AS01-SB74	AS01-SB74-4-4_5	09/23/04	4	5	SS			0.00	0.07							0.01			0.07	0.44	0.67	6.60	1.03	53.8	0.94	1.10	0.11	4.43	0.46	0.31	0.86
E-OABG	AS01-SB53	AS01-SS53-0-1	07/21/04	0	1	SS				44.4	0.00	0.02	0.00		0.03	0.02				1.40	0.78	0.63	1.49	0.38	1.12	0.81	1.67	0.62	0.90	1.00	1.00	1.20
W-OABG	BG-098/098S	HCS-BG-98S	11/16/94	0	1	SS				33.3	0.01	0.03	0.00		0.07	0.05					0.99		0.55	0.60	0.30	1.08	0.07	0.29	0.65	0.08	0.15	0.18
E-OABG	AS01-TP28	AS01-DC09-0304	03/28/08	3	4	SS			1.00	32.1											0.39	0.43	0.92	0.34	2.36	0.70	0.85	0.93	0.70	1.29	0.15	1.32
W-OABG	AS01-SB26	AS01-SB26-(1-2)	10/23/01	1	2	SS				30.9	0.01	0.06	0.01		0.06	0.07					1.29		0.49	0.54	0.26	1.03	0.09	0.43	0.54		0.12	0.18
W-OABG	AS01-SB26	AS01-SS26-(0-1)	10/23/01	0	1	SS				0.15	0.02	0.08	0.01	0.20	0.06	0.12					1.15		0.42	0.84	0.22	0.97	0.07	0.11	1.07		0.15	0.18
E-OABG	BG-102/102S	HCS-BG-102	07/13/92	1	2	SS	0.58		1.27	30.9																						
E-OABG	BG-102/102S	HCS-BG-102S	11/16/94	0	1	SS			0.03	1.10	0.01	0.04	0.01		0.06	0.05					0.71		0.31	0.74	0.15	0.92	0.05	0.09	0.75		0.12	0.18

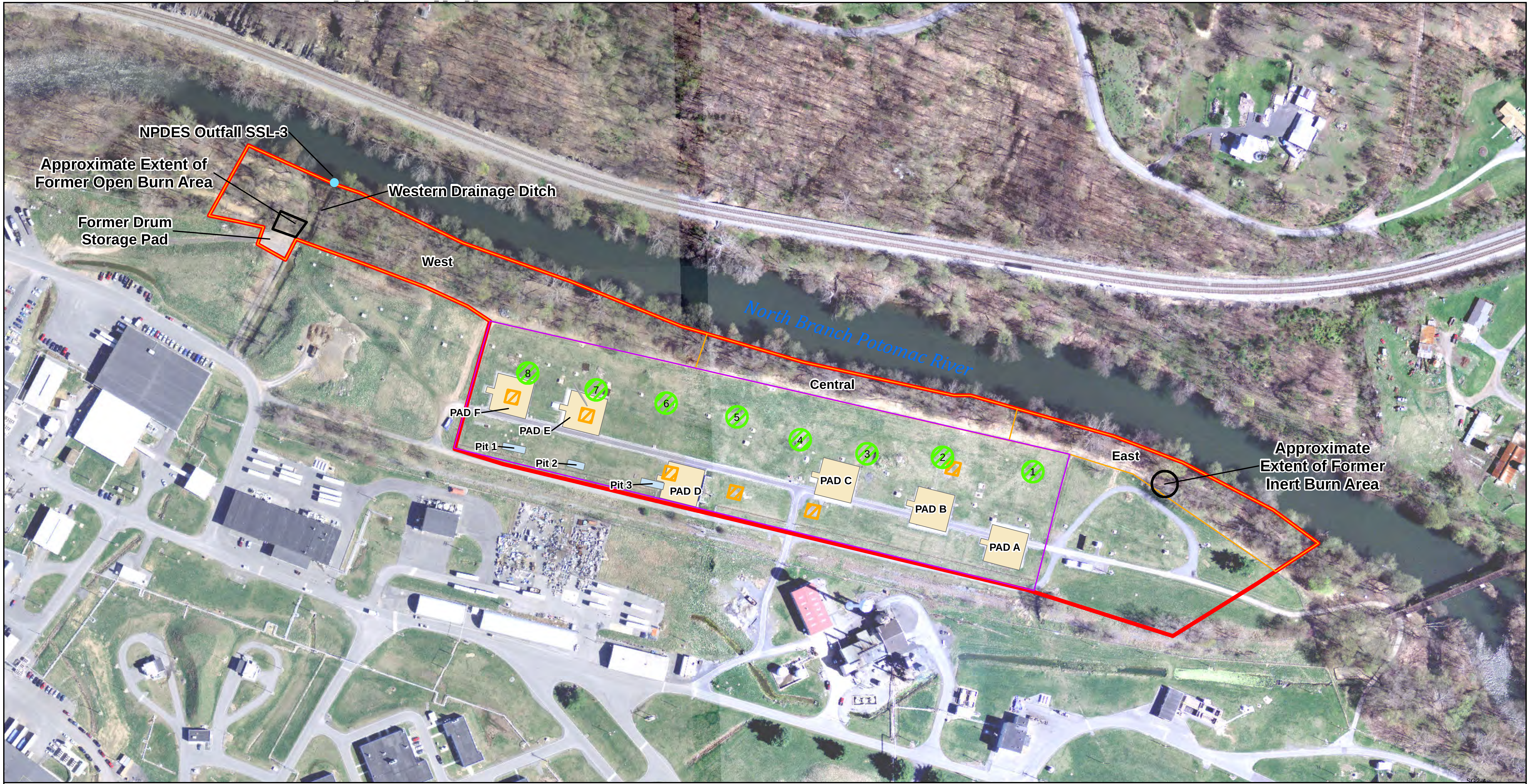
Table 14
Outside Active Burning Grounds - Industrial Removal Scenario (UCL)
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

							COC CONCENTRATION-to-SRG RATIOS																									
							VOCs (ug/kg)				SVOCs (ug/kg)						Explosives (ug/kg)			Dioxins/ Furans (mg/kg)	Metals (mg/kg)											
						INDUSTRIAL SRGs - Surface Soil (SS):																										
						INDUSTRIAL SRGs - Subsurface Soil (SB):																										
Area	Station ID	Sample ID	Sample Date	Top of Sample (ft)	Sample Bottom (ft)	Sample Designation	1,2-Dichloroethene (total)	Methyl acetate	Tetrachloroethene	Trichloroethene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Dibenz(a,h)anthracene	Total PAHs - LMW	Total PAHs - HMW	HMX	Nitroglycerin	RDX	TEQs	Arsenic	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Nickel	Silver	Vanadium	Zinc
W-OABG	AS01-SB25	AS01-SB25-(1-2)	10/24/01	1	2	SS					6.59	26.2	3.10	1.00	8.28	27.3					0.46		0.23	0.31	0.11	0.47	0.03	0.28	0.32	0.04	0.06	0.11
W-OABG	AS01-SB25	AS01-SS25-(0-1)	10/24/01	0	1	SS					0.08	0.36	0.05		0.12	0.34					1.14	0.05	0.36	1.06	0.19	0.91	0.06	0.17	0.99	0.09	0.13	0.21
E-OABG	BG-146	HCS-BG-146	11/16/94	2	3	SS			2.00	24.7																						
W-OABG	BG-150	HCS-BG-150	11/15/94	2	3	SS				21.0	0.01	0.04			0.05	0.07					0.52		0.21	0.39	0.12	0.71	0.04	0.14	0.40	0.05	0.10	0.11
W-OABG	AS01-SB39	AS01-SB39-(1-2)	10/23/01	1	2	SS				19.8	0.04	0.15	0.02		0.07	0.17					1.34	0.05	0.56	0.54	0.28	0.96	0.11	0.49	0.55		0.12	0.19
W-OABG	AS01-SB39	AS01-SS39-(0-1)	10/23/01	0	1	SS				0.22	0.01	0.05	0.01		0.05	0.07					0.82		0.29	0.73	0.15	0.65	0.06		0.70		0.09	0.14
E-OABG	AS01-SB30	AS01-SB30-(1-2)	10/24/01	1	2	SS			0.01	16.0	0.04	0.16	0.02		0.08	0.18				0.13	1.94	0.71	2.62	0.77	1.31	3.43	3.24	2.80	0.81	1.01	0.15	0.85
E-OABG	AS01-SB30	AS01-SS30-(0-1)	10/24/01	0	1	SS				0.03	0.03	0.11	0.01		0.06	0.13				0.04	0.66		0.22	0.98	0.14	0.53	0.05		0.96		0.08	0.18
E-OABG	B1-004	HCS-B1-4-S	07/17/92	0.5	1	SS															0.53	3.28	2.34	0.76	3.08	3.43	15.4	0.62	1.36	0.30	0.10	3.30
E-OABG	AS01-TP28	AS01-TP28-0910	03/28/08	9	10	SB			0.02	14.8											0.29	0.00		0.37	0.00	0.76	0.01					
W-OABG	AS01-TP15	AS01-TP15-0910	03/25/08	9	10	SB				13.6											0.29	0.00		0.48	0.00	0.66	0.01					
					UCL Step 1																											
					Maximum - All depths		0.12	2.83	0.66	9.38	0.92	5.71	1.00	0.11	2.18	4.58	0.15	--	1.17	2.31	1.56	8.85	2.41	1.81	8.50	2.28	8.51	3.29	2.59	2.84	5.75	2.86
					Maximum - SS		0.12	2.83	0.66	7.90	0.92	5.71	1.00	0.11	2.18	4.58	0.15	--	1.17	2.31	1.56	8.85	2.41	1.15	8.50	2.28	8.51	3.29	2.59	2.84	5.75	2.86
					Ecological PRG																											
					Maximum ratio																											
STEP 2 (SRG Ratio >5)																																
W-OABG	AS01-TP05	AS01-DC01-0506	03/19/08	5	6	SB				9.38	0.02	0.09	0.01							0.80	0.39	0.06		0.97	0.06	0.83	0.21	0.13				
E-OABG	B1-011	HCS-B1-11-S	07/17/92	1	2	SS															0.89	8.85	2.41	0.60	3.38	1.28	8.51	1.55	0.95	0.58	0.18	1.85
E-OABG	B1-011	HCS-B1-11-2	07/17/92	0.5	1	SS															0.80	2.69	2.34	0.51	5.49	2.28	1.26	2.86	1.30	2.44	0.56	2.86
W-OABG	AS01-TP13	AS01-TP13-0910	03/25/08	9	10	SB				8.52											0.29	0.00		0.50	0.00	0.62	0.01					
W-OABG	B2-007	HCS-B2-7-S	07/17/92	1	2	SS															0.89	0.11	0.70	0.49	8.50	0.71	0.35	1.68	0.51	2.84	0.48	0.54
E-OABG	AS01-SB52	AS01-SS52-0-1	07/21/04	0	1	SS		1.00	0.51	7.90	0.01	0.03	0.00		0.04	0.02				1.25	0.54	0.26	1.00	0.39	1.00	1.60	0.75	1.30	0.64	0.06	0.13	1.00
E-OABG	BG-149	HCS-BG-149	11/16/94	2	3	SS				7.90																						
E-OABG	B1-C	HCS-B1-C	07/17/92	0	1	SS														2.31	0.46	0.19	0.23	0.11	0.32	0.29	6.36	1.30	0.15	0.21	0.03	0.25
W-OABG	AS01-TP09	AS01-DC02-0405	03/20/08	4	5	SS				0.02		0.05	0.01		0.06	0.06				0.32	0.45	0.48	0.86	0.25	0.27	0.66	0.23		2.59	0.04	5.75	0.62
W-OABG	AS01-SB57	AS01-SS57-0-1	07/21/04	0	1	SS					0.92	5.71	0.76		2.18	4.58				0.28	0.70	0.30	1.39	0.30	2.04	0.85	1.20	0.27	0.58	0.13	0.34	0.72
W-OABG	BG-139	HCS-BG-139	11/15/94	2	3	SS				5.43																						
					UCL Step 2																											
					Maximum - All depths		0.12	2.83	0.66	4.44	0.85	4.29	1.00	0.11	0.51	4.02	0.15	--	1.17	1.96	1.56	4.87	1.82	1.81	3.95	1.99	2.08	3.29	1.20	2.24	0.62	1.20
					Maximum - SS		0.12	2.83	0.66	4.44	0.85	4.29	1.00	0.11	0.51	4.02	0.15	--	1.17	1.96	1.56	4.87	1.82	1.15	3.95	1.99	2.08	3.29	1.20	2.24	0.62	1.20
					Ecological PRG																											
					Maximum ratio																											
STEP 3																																
W-OABG	AS01-SB34	AS01-SB34-(1-2)	10/25/01	1	2	SS				0.03	0.02	0.09	0.01		0.05	0.12				0.76	0.94	0.72	0.87	0.78	3.95	1.15	0.27	0.35	0.94	2.24	0.46	0.92
W-OABG	AS01-SB34	AS01-SS34-(0-1)	10/25/01	0	1	SS				0.01	0.04	0.16	0.02		0.06	0.17					1.03	0.05	0.35	1.15	0.24	0.91	0.06	0.25	1.01	0.23	0.12	0.24
W-OABG	AS01-SB48	AS01-SS48-0-1	07/20/04	0	1	SS		2.83		4.44	0.01	0.04	0.01		0.03	0.04					0.53		0.33	0.45	0.17	0.79	0.06	0.62	0.47	0.08	0.13	0.14
W-OABG	AS01-SB49	AS01-SS49-0-1	07/20/04	0	1	SS		1.50		1.22	0.85	4.29	1.00		0.51	4.02					0.78		0.46	0.66	0.17	0.91	0.06	0.22	0.70		0.13	0.15
					UCL Step 3																											
					Maximum - All depths		0.12	1.07	0.66	3.33	0.19	0.67	0.07	0.11	0.25	0.64	0.15	--	1.17	1.96	1.56	4.87	1.82	1.81	3.84	1.99	2.08	3.29	1.20	1.85	0.62	1.20
					Maximum - SS		0.12	1.07	0.66	3.33	0.19	0.67	0.07	0.11	0.25	0.64	0.15	--	1.17	1.96	1.56	4.87	1.82	1.11	3.84	1.99	2.08	3.29	1.20	1.85	0.62	1.20
					Ecological PRG																											
					Maximum ratio																											
Gray shaded concentrations indicate detections; NA - Not Analyzed																																

Notes:
µg/kg = microgram per kilogram
COC = constituent of concern
ft = foot
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
ID = identification
mg/kg = milligram per kilogram
RDX = Hexahydro-1,2,5-trinitro-1,3,5-triazine
SRG = site remediation goal
VOC = volatile organic compound

Figures

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\380119_SITE_1_FS\FINAL\FIGURE_1_SITE_1_FEATURES.MXD BALDRIDGE 10/12/2012 9:59:52 AM



Legend

- NPDES Outfall SSL-3
- Former Inert and Open Burn Area
- Former Disposal Pits
- Active Burning Ground
- Outside Active Burning Ground
- Former Earthen Burn Pads
- Approximate location of former burn pans
- Current Concrete Burn Pads
- Site 1 Boundary

N

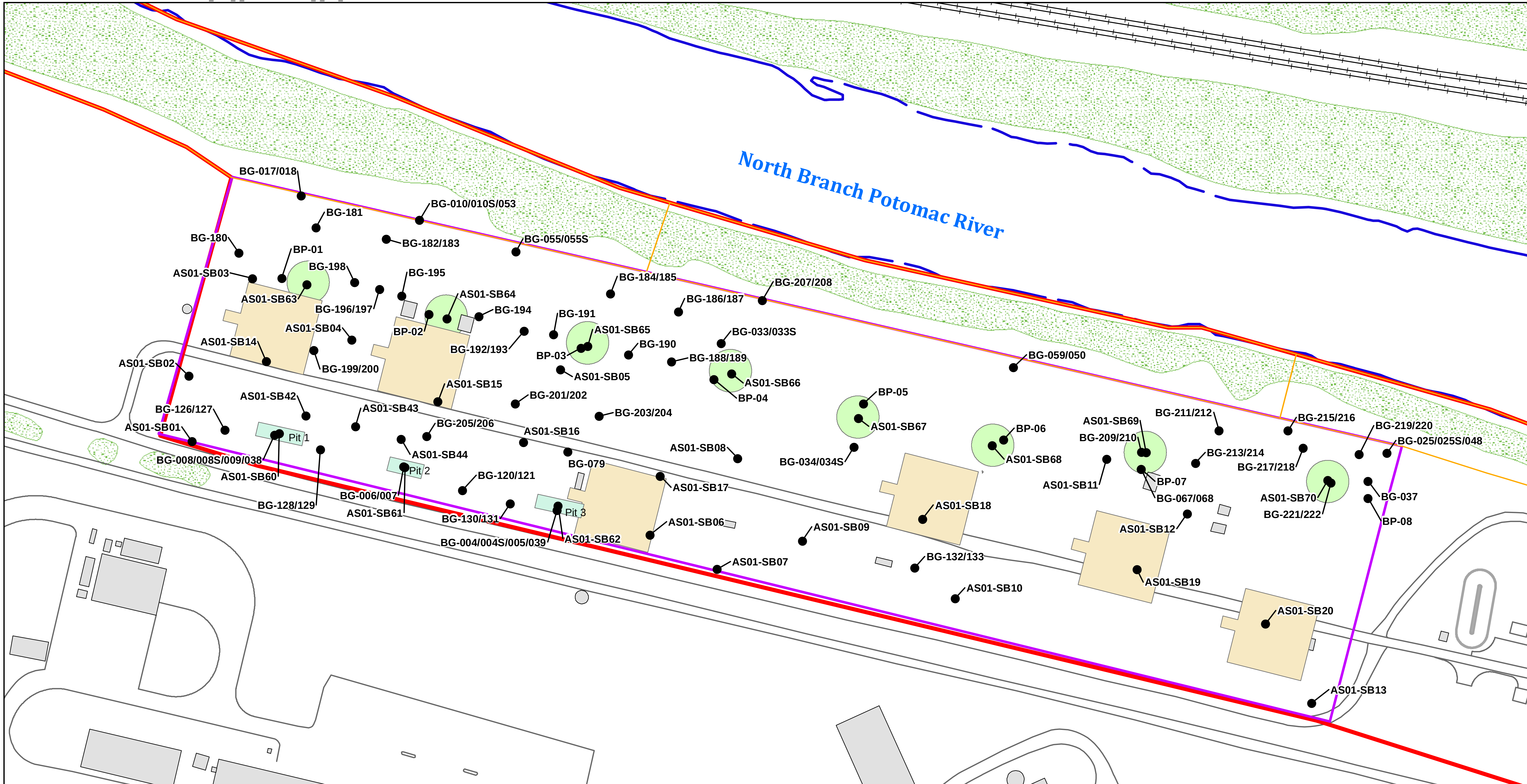
0 100 200 Feet

1 inch = 200 feet

Figure 1
Site 1 Features
Site Remediation Goal Selection Process and
Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

R:\USNAVFACENGCOM405450\ABL\MAPFILES\380119_SITE_1_FS\FINAL\FIGURE_2_ALL_SAMPLES.MXD BALDRIDGE 10/25/2012 2:20:42 PM



Legend

- Sample location included in the ABG data set
- Water
- Roads
- Railroads
- Former Earthen Burn Pads
- Former Disposal Pits
- Structures
- Current Concrete Burn Pads
- Outside Active Burning Ground
- Active Burning Ground
- Site 1 Boundary
- Vegetation

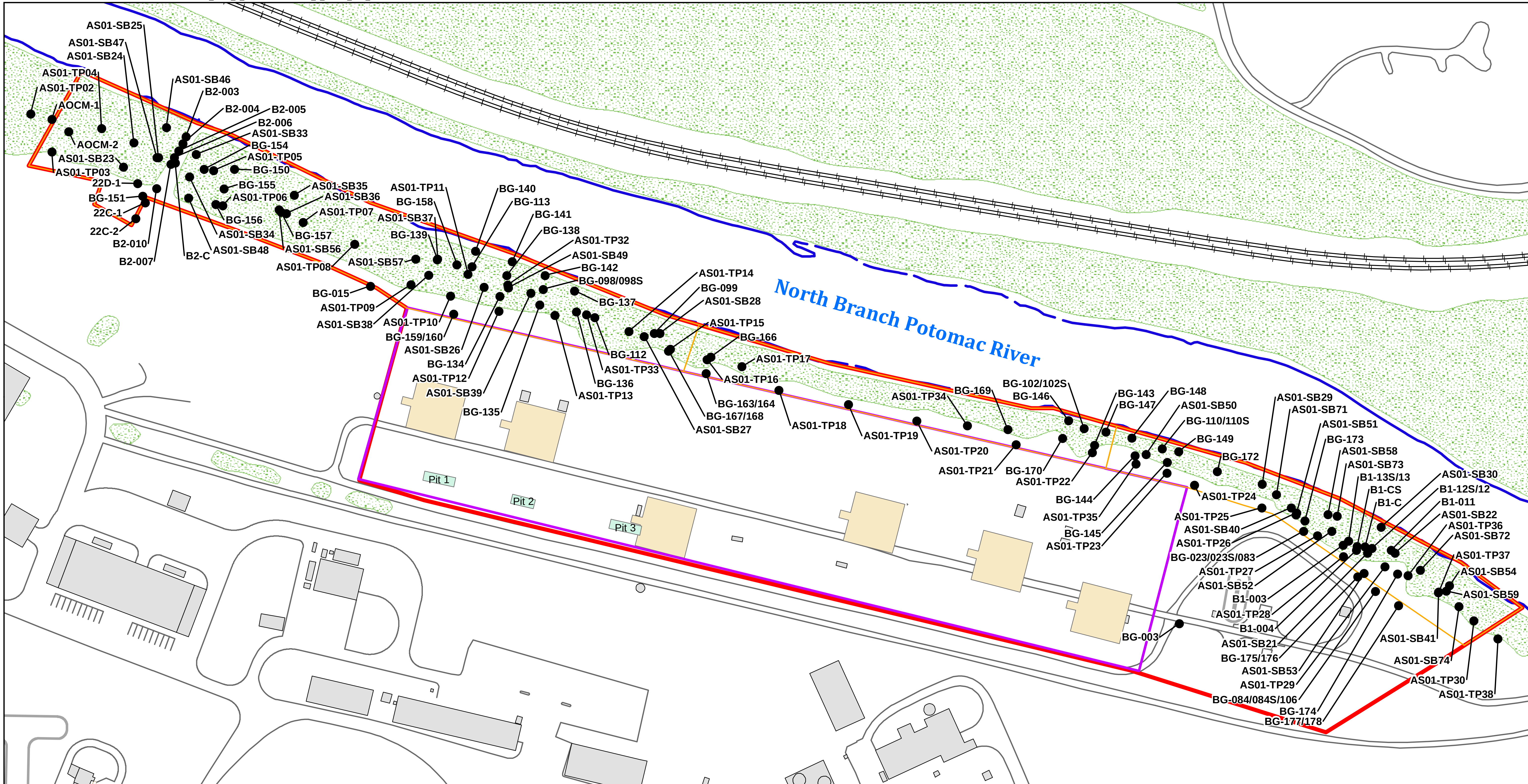
N

0 50 100 Feet

1 inch = 100 feet

Figure 2
Site 1 ABG Sample Locations
Site Remediation Goal Selection Process and
Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL



Legend

- Sample location included in the OABG data set
- Water
- Roads
- Railroads
- Former Disposal Pits
- Structures
- Current Concrete Burn Pads
- Outside Active Burning Ground
- Active Burning Ground
- Site 1 Boundary
- Vegetation

N

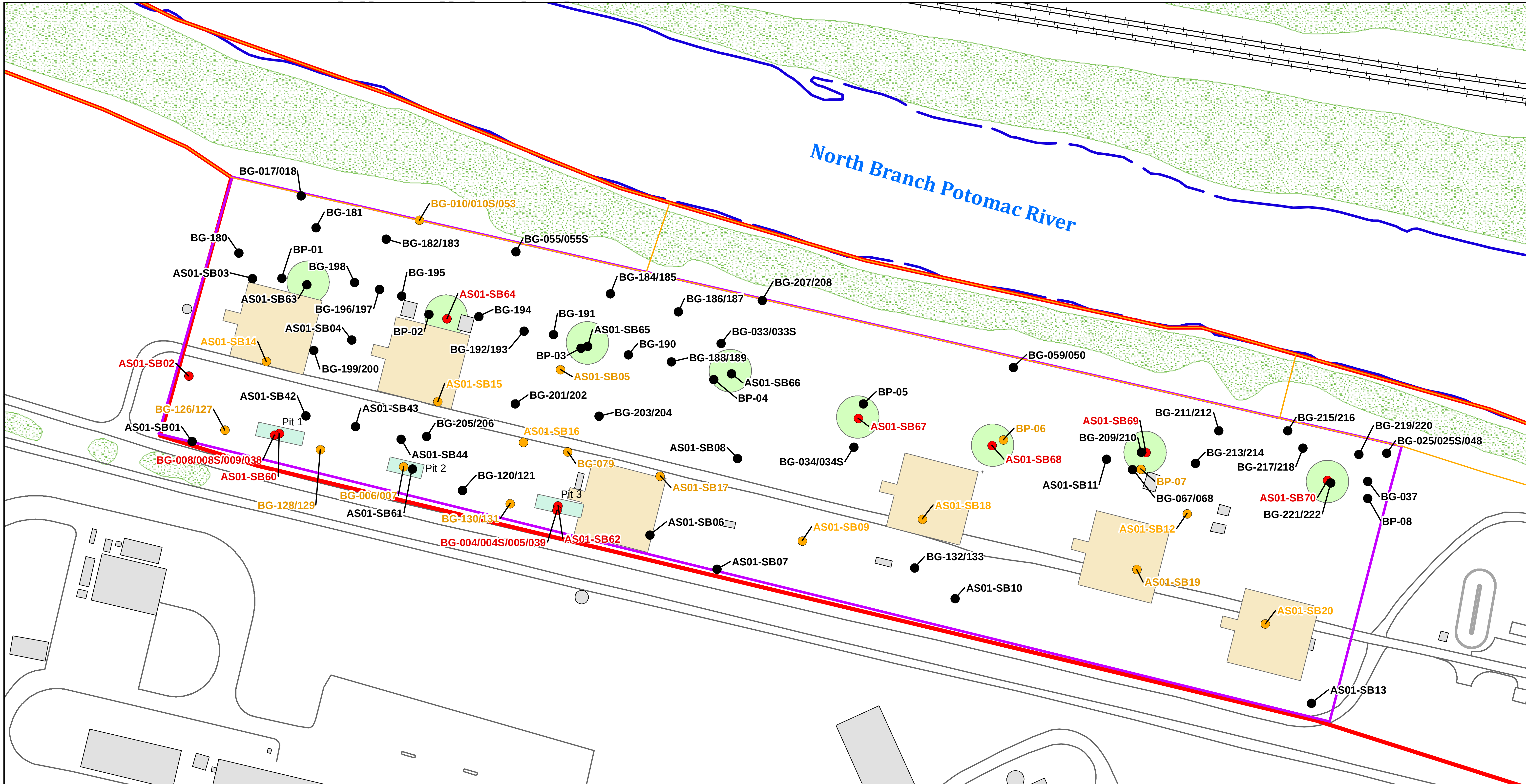
0 75 150 Feet

1 inch = 150 feet

Figure 3
Site 1 OABG Sample Locations
Site Remediation Goal Selection Process and
Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\380119_SITE_1_FS\FINAL\FIGURE_4_ABG_INDUSTRIAL_BASELINE_SAMPLES.MXD BALDRIDGE 10/25/2012 2:27:03 PM



Legend

- Does not exceed ABG industrial SRG
- Exceeds ABG industrial SRG; SRG ratio > 5.0
- Exceeds ABG industrial SRG; 1.0 < SRG ratio ≤ 5.0
- Water
- Roads
- Railroads
- Former Disposal Pits
- Structures
- Active Burning Ground
- Outside Active Burning Ground
- Former Earthen Burn Pads
- Current Concrete Burn Pads
- Vegetation
- Site 1 Boundary

N

0 50 100 Feet

1 inch = 100 feet

Figure 4
Site 1 ABG Baseline Industrial SRG Scenario
Site Remediation Goal Selection Process and
Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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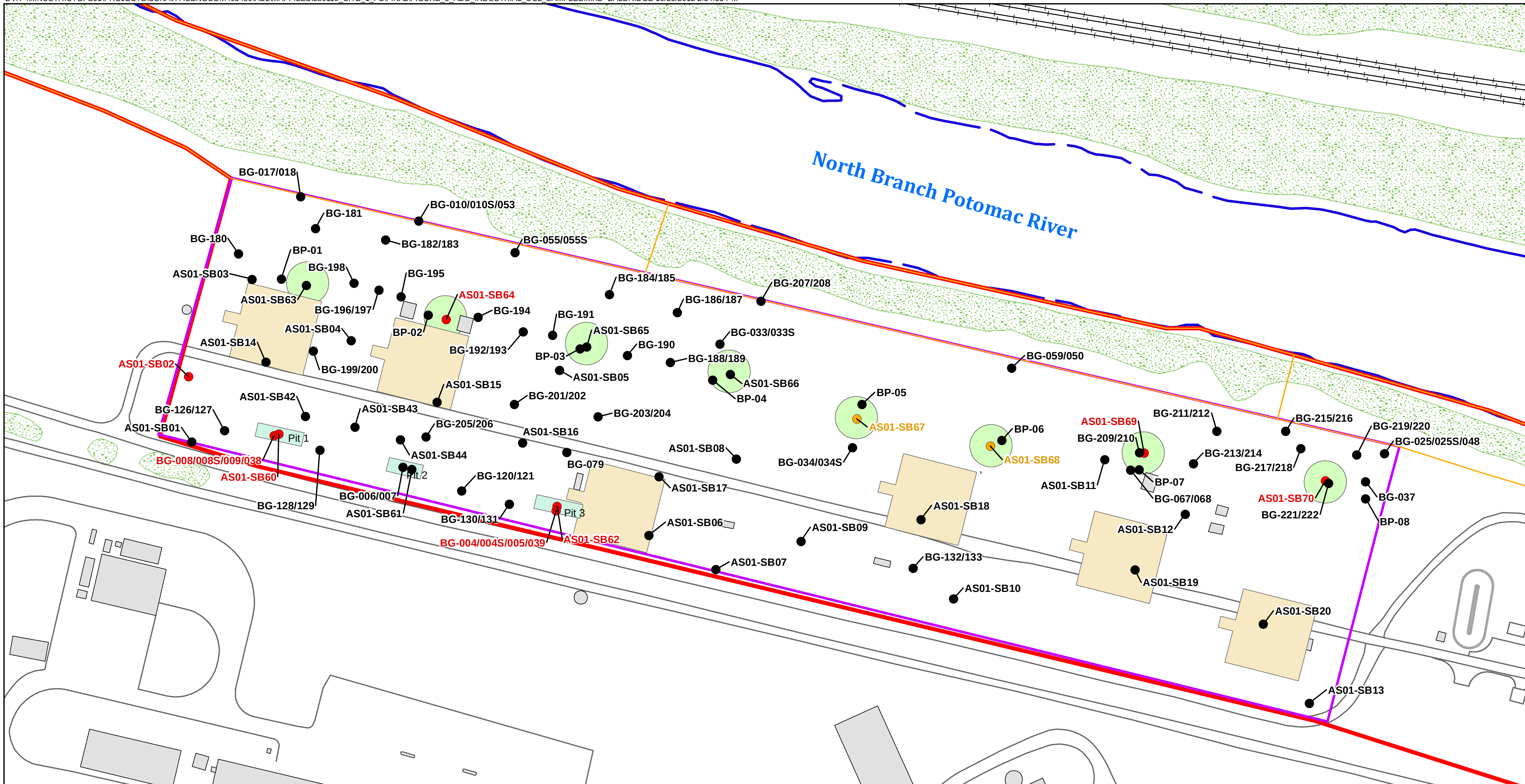
DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\380119_SITE_1_FS\FINAL\FIGURE_5_ABG_INDUSTRIAL_UCL_SAMPLES.MXD BALDRIDGE 10/25/2012 2:34:33 PM



Legend

- Removal not required for the 95% UCL to achieve the ABG industrial SRG
- Removal required for the 95% UCL to achieve the ABG industrial SRG
- Removal not required for the 95% UCL to achieve the ABG industrial SRG; however, sample removed because SRG ratio > 5.0
- Water
- Roads
- Railroads
- Former Disposal Pits
- Structures
- Active Burning Ground
- Outside Active Burning Ground
- Former Earthen Burn Pads
- Current Concrete Burn Pads
- Vegetation
- Site 1 Boundary

N

0 50 100 Feet

1 inch = 100 feet

Figure 5
Site 1 ABG UCL Industrial SRG Scenario
Site Remediation Goal Selection Process and
Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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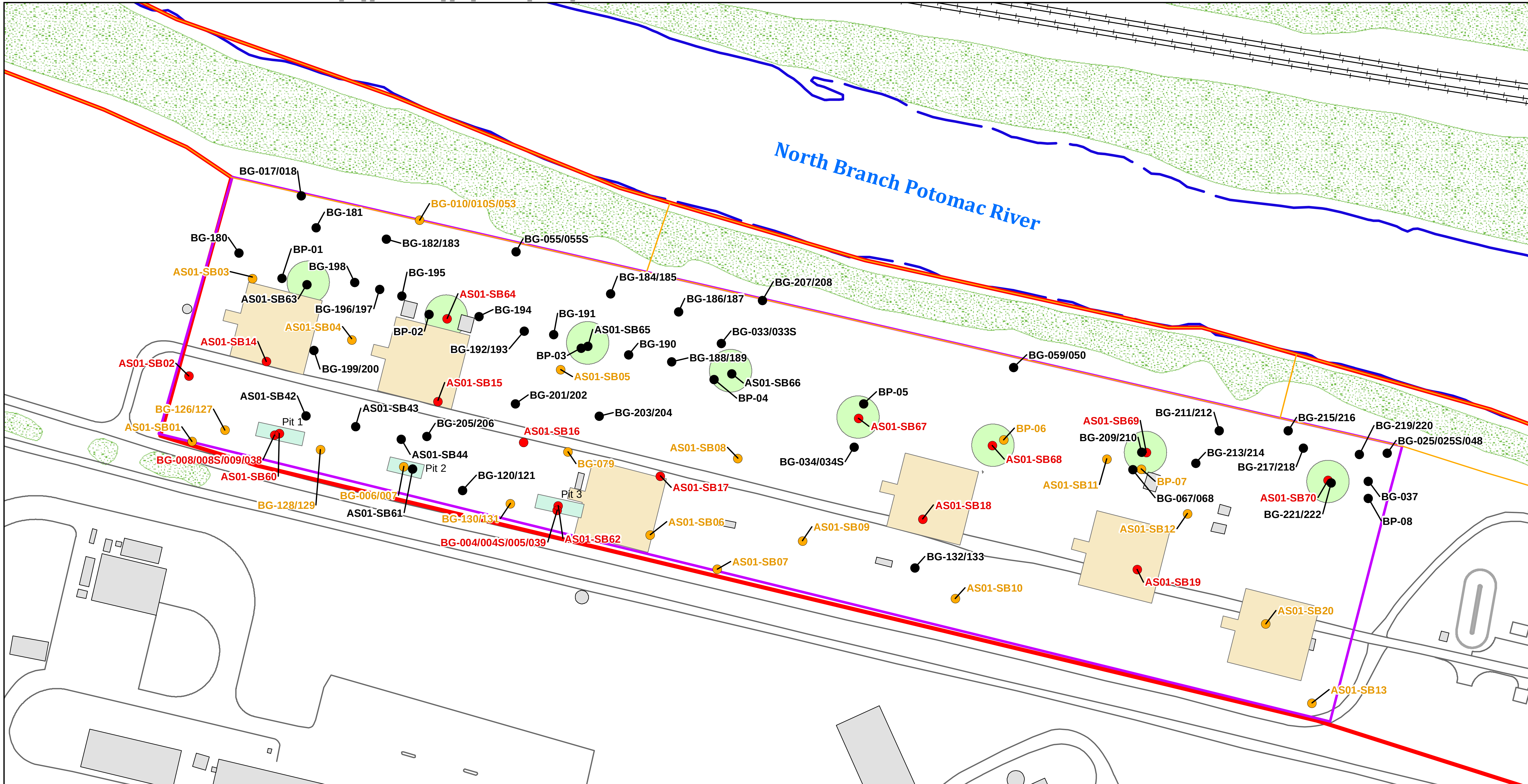
DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\380119_SITE_1_FS\FINAL\FIGURE_6_ABG_RESIDENTIAL_BASELINE_SAMPLES.MXD BALDRIDGE 10/25/2012 2:37:05 PM



Legend

- Does not exceed ABG residential SRG
- Exceeds ABG residential SRG; SRG ratio > 5.0
- Exceeds ABG residential SRG; 1.0 < SRG ratio ≤ 5.0
- Water
- Roads
- Railroads
- Former Disposal Pits
- Structures
- Active Burning Ground
- Outside Active Burning Ground
- Former Earthen Burn Pads
- Current Concrete Burn Pads
- Vegetation
- Site 1 Boundary

N

0 50 100 Feet

1 inch = 100 feet

Figure 6
Site 1 ABG Baseline Residential SRG Scenario
Site Remediation Goal Selection Process and
Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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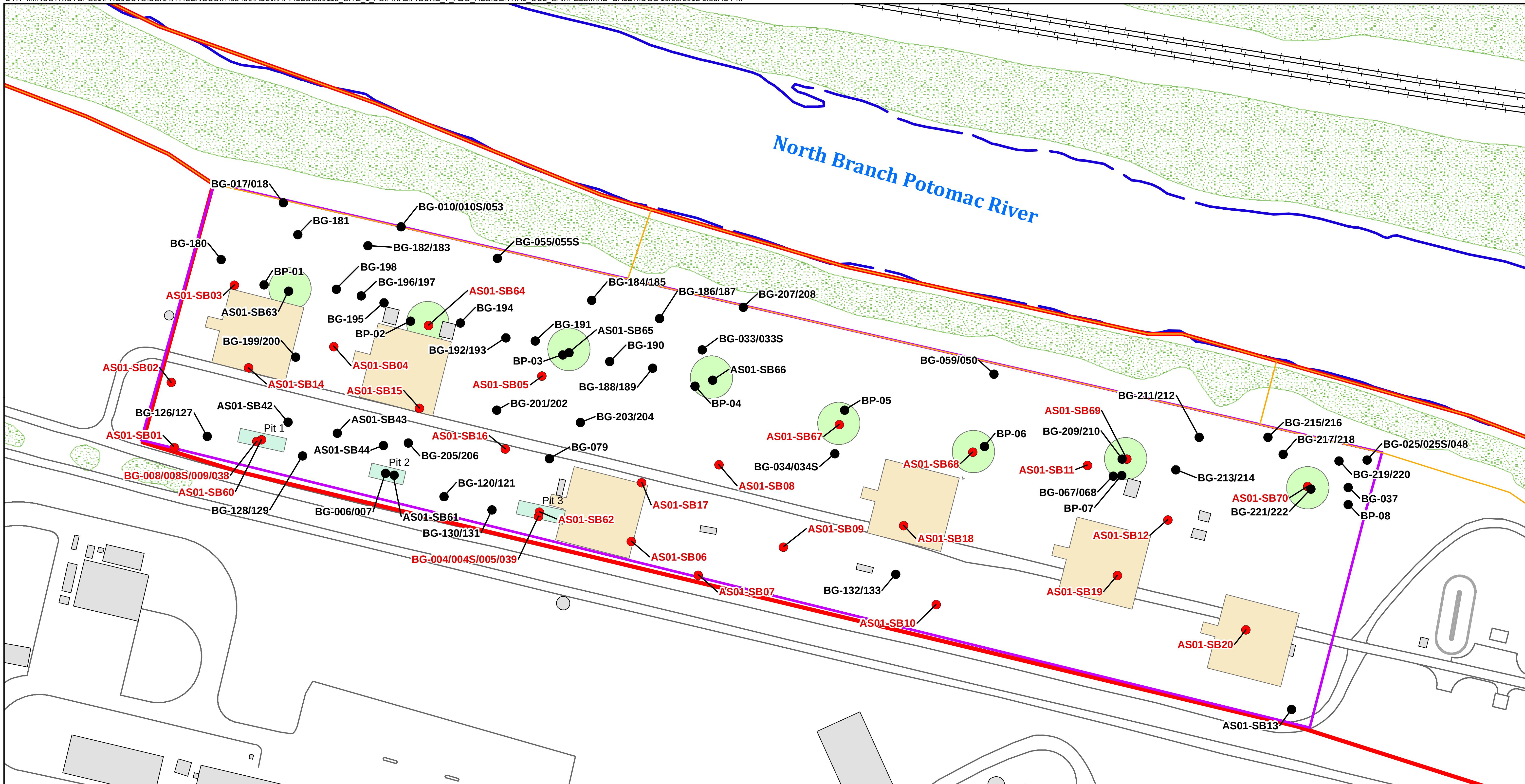
DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\380119_SITE_1_FS\FINAL\FIGURE_7_ABG_RESIDENTIAL_UCL_SAMPLES.MXD BALDRIDGE 10/25/2012 2:55:42 PM



Legend

- Removal not required for the 95% UCL to achieve the ABG residential SRG
- Removal required for the 95% UCL to achieve the ABG residential SRG
- Water
- Roads
- Railroads
- Former Disposal Pits
- Structures
- Active Burning Ground
- Outside Active Burning Ground
- Current Concrete Burn Pads
- Former Earthen Burn Pads
- Vegetation
- Site 1 Boundary

N

0 50 100
Feet

1 inch = 100 feet

Figure 7
Site 1 ABG UCL Residential SRG Scenario
Site Remediation Goal Selection Process and
Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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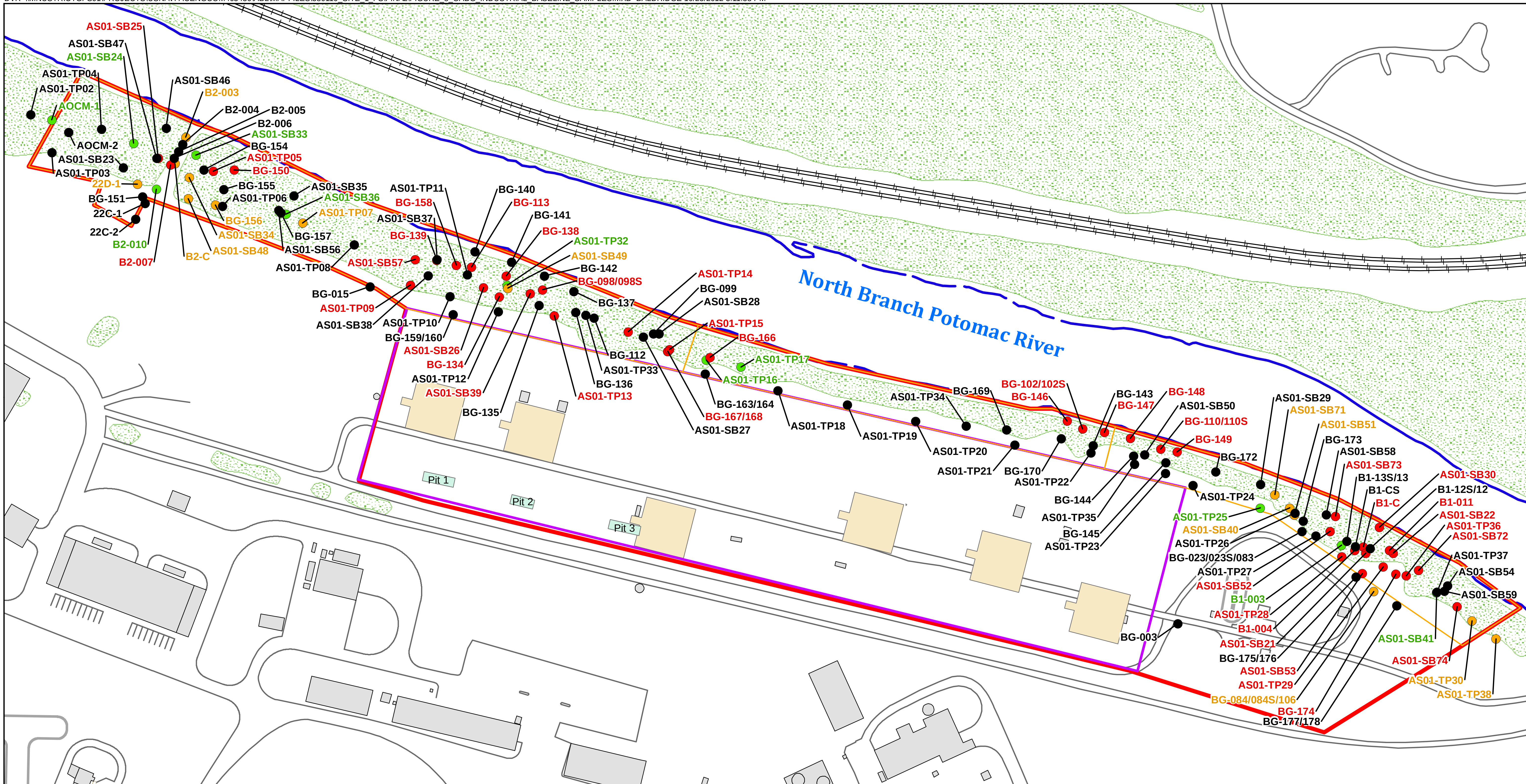
DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\380119_SITE_1_FS\FINAL\FIGURE_8_OABG_INDUSTRIAL_BASELINE_SAMPLES.MXD BALDRIDGE 10/25/2012 3:11:58 PM



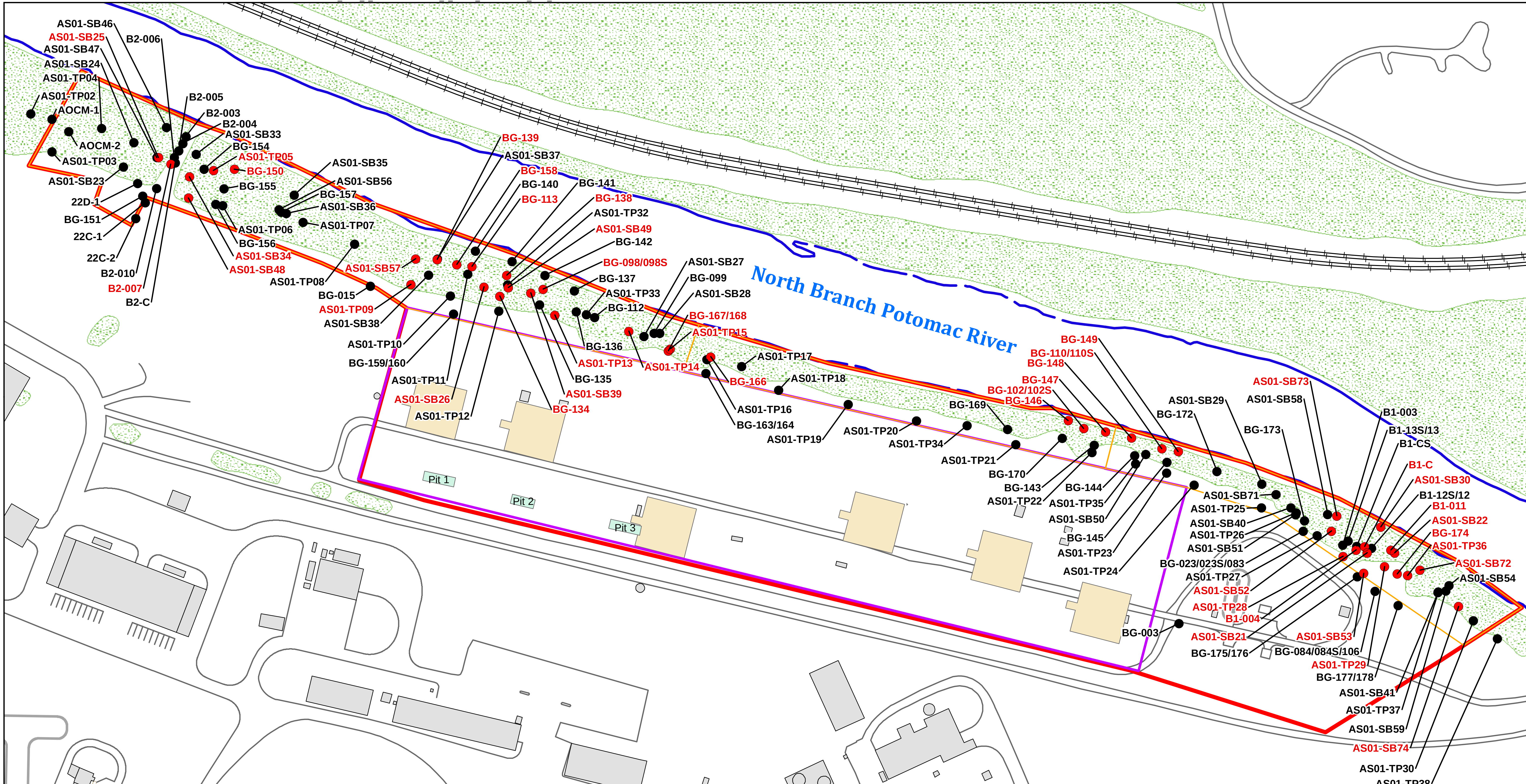
Legend

- Does not exceed OABG industrial SRG
- Exceeds OABG industrial SRG; SRG ratio > 5.0
- Exceeds OABG industrial SRG; 1.5 < SRG ratio ≤ 5.0
- Exceeds OABG industrial SRG; 1.0 < SRG ≤ 1.5
- Water
- Roads
- Railroads
- Former Disposal Pits
- Structures
- Active Burning Ground
- Outside Active Burning Ground
- Current Concrete Burn Pads
- Vegetation
- Site 1 Boundary

Figure 8
Site 1 OABG Baseline Industrial SRG Scenario
Site Remediation Goal Selection Process and
Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

CH2MHILL

DVR \\MNUSTRICTGFS01\PROJECTS\USNAVFACENGCOM405450\ABL\MAPFILES\380119_SITE_1_FS\FINAL\FIGURE_9_OABG_INDUSTRIAL_UCL_SAMPLES.MXD BALDRIDGE 10/25/2012 3:16:09 PM



Legend

- ● Removal not required for the 95% UCL to achieve the OABG industrial SRG
- ● Removal required for the 95% UCL to achieve the OABG industrial SRG
- Water
- Roads
- Railroads
- Former Disposal Pits
- Structures
- Active Burning Ground
- Outside Active Burning Ground
- Current Concrete Burn Pads
- Vegetation
- Site 1 Boundary

N

0 75 150 Feet

1 inch = 150 feet

Figure 9
Site 1 OABG UCL Industrial SRG Scenario
Site Remediation Goal Selection Process and
Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

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Attachment A
Supporting Calculations for Human Health Risk Based PRGs

Table A-1
Summary of PRGs Calculated for COCs for OABG
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Constituent	Industrial Worker PRGs (mg/kg)	Basis of PRG	Construction Worker PRGs (mg/kg)	Basis of PRG	Residential PRGs (mg/kg)	Basis of PRG
Tetrachloroethene	61	HI = 0.5	124	HQ = 1	37	HI = 0.5
Trichloroethene	4	HI = 0.5	70	HQ = 0.5	2.5	HI = 0.5
Benzo(a)anthracene	21	CR = 10^{-5}	214	CR = 10^{-5}	1.5	CR = 10^{-5}
Benzo(a)pyrene	2.1	CR = 10^{-5}	21	CR = 10^{-5}	0.15	CR = 10^{-5}
Benzo(b)fluoranthene	21	CR = 10^{-5}	214	CR = 10^{-5}	1.5	CR = 10^{-5}
Benzo(k)fluoranthene	211	CR = 10^{-5}	2136	CR = 10^{-5}	15	CR = 10^{-5}
Dibenz(a,h)anthracene	2.1	CR = 10^{-5}	21	CR = 10^{-5}	0.15	CR = 10^{-5}
Indeno(1,2,3-cd)pyrene	21	CR = 10^{-5}	214	CR = 10^{-5}	1.5	CR = 10^{-5}
2,3,7,8-TCDD (dioxin)	0.00018	CR = 10^{-5}	0.0015	CR = 10^{-5}	0.000025	HI = 0.5
Antimony	284	HI = 1	103	HI = 1	26	HI = 1
Arsenic	16	CR = 10^{-5}	85	HI = 1	3.9	CR = 10^{-5}
Cadmium	792	HI = 1	140	HI = 1	70	HI = 1
Chromium (III)	252266	HI = 1	140444	HI = 1	37199	HI = 1
Copper	19174	HI = 0.5	6014	HI = 0.5	1522	HI = 0.5
Iron	335553	HI = 0.5	105237	HI = 0.5	26629	HI = 0.5
Lead	1235	ALM	618	ALM	418	IEUBK
Manganese	4222	HI = 0.5	2034	HI = 0.5	543	HI = 0.5
Mercury	79	HI = 0.5	65	HI = 1	8.4	HI = 0.5
Thallium	5	HI = 0.5	6.0	HI = 0.5	0.38	HI = 0.5
Vanadium	2397	HI = 0.5	752	HI = 0.5	190	HI = 0.5

Notes: HI = Hazard Index CR = Cancer Risk ALM = Adult Lead Model
IEUBK = Integrated Exposure Update Biokinetic Model for Lead in Children

Table A-2
Summary of PRGs Calculated for COCs for FDP
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Constituent	Industrial Worker PRGs (mg/kg)	Basis of PRG	Construction Worker PRGs (mg/kg)	Basis of PRG	Residential PRGs (mg/kg)	Basis of PRG
Trichloroethene	4	HI = 0.5	70	HI = 0.5	2.5	HI = 0.5
2,3,7,8-TCDD (dioxin)	0.00018	CR = 10^{-5}	0.0015	CR = 10^{-5}	0.000025	HI = 0.5
Arsenic	16	CR = 10^{-5}	85	HI = 1	3.9	CR = 10^{-5}
Iron	671107	HI = 1	210474	HI = 1	53259	HI = 1
Manganese	8445	HI = 1	2034	HI = 0.5	1087	HI = 1
Thallium	4.8	HI = 0.5	6.0	HI = 0.5	0.38	HI = 0.5
Vanadium	2397	HI = 0.5	752	HI = 0.5	190	HI = 0.5

Notes: HI = Hazard Index CR = Cancer Risk

Table A-3
Summary of PRGs Calculated for COCs for ABG
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Constituent	Industrial Worker PRGs (mg/kg)	Basis of PRG	Construction Worker PRGs (mg/kg)	Basis of PRG	Residential PRGs (mg/kg)	Basis of PRG
Perchlorate	671	HI = 1	210	HI = 1	53	HI = 1
Arsenic	16	CR = 10^{-5}	85	HI = 1	3.9	CR = 10^{-5}
Iron	671107	HI = 1	210474	HI = 1	53259	HI = 1
Manganese	8445	HI = 1	4068	HI = 1	1087	HI = 1
Thallium	4.8	HI = 0.5	6.0	HI = 0.5	0.38	HI = 0.5
Vanadium	2397	HI = 0.5	752	HI = 0.5	190	HI = 0.5

Notes: HI = Hazard Index CR = Cancer Risk

Table A-4

Human Health Risk-Based Preliminary Remediation Goals

Child Residential Scenario (Noncarcinogenic) for OABG

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Chronic Oral RfD (RfDo) (mg/kg-day)	Chronic Dermal RfD (RfDd) (mg/kg-day)	Chronic Inhalation RfC (RfC) (mg/m^3)	Target Organ	Absorption Factor (ABS)	Volatilization Factor (VF) (m^3/kg)	An	Bn	Cn	Noncarcinogen PRG HQ = 0.1 (mg/kg)	Noncarcinogen PRG HQ = 0.5 (mg/kg)	Noncarcinogen PRG HQ = 1 (mg/kg)	Noncarcinogen PRG PRG (mg/kg)	Noncarcinogen PRG Target HQ[1] (mg/kg)
VOCs														
Tetrachloroethene	6.0E-03	6.0E-03	4.0E-02	Neurological	1.0E-02	2.1E+03	3.3E-02	9.3E-04	1.2E-02	7.4E+00	3.7E+01	7.4E+01	**3.7E+01**	0.5
Trichloroethene	5.0E-04	5.0E-04	2.0E-03	Development and Adult Immunotoxicity, Fetal Cardiac	1.0E-02	2.7E+03	4.0E-01	1.1E-02	1.8E-01	4.9E-01	2.5E+00	4.9E+00	**2.5E+00**	0.5
SVOCs														
Benzo(a)anthracene	NA	NA	NA											
Benzo(a)pyrene	NA	NA	NA											
Benzo(b)fluoranthene	NA	NA	NA											
Benzo(k)fluoranthene	NA	NA	NA											
Dibenz(a,h)anthracene	NA	NA	NA											
Indeno(1,2,3-cd)pyrene	NA	NA	NA											
Dioxins/Furans														
2,3,7,8-TCDD (dioxin)	7.0E-10	7.0E-10	4.0E-08	Sperm, Developmental, Liver, Development, Endocrine	3.0E-02	NA	2.9E+05	2.4E+04	1.9E-02	5.1E-06	2.5E-05	5.1E-05	**2.5E-05**	0.5
Inorganics														
Antimony	4.0E-04	6.0E-05	NA	Longevitiy, Blood	1.0E-02	NA	5.0E-01	9.3E-02		2.6E+00	1.3E+01	2.6E+01	**2.6E+01**	1
Arsenic	3.0E-04	3.0E-04	1.5E-05	Skin, Vascular	3.0E-02	NA	6.7E-01	5.6E-02	5.1E-05	2.2E+00	1.1E+01	2.2E+01	**2.2E+01**	1
Cadmium	1.0E-03	2.5E-05	2.0E-05	Kidney	1.0E-03	NA	2.0E-01	2.2E-02	3.8E-05	7.0E+00	3.5E+01	7.0E+01	**7.0E+01**	1
Chromium (III)	1.5E+00	2.0E-02	NA	Not identified	1.0E-02	NA	1.3E-04	2.9E-04		3.7E+03	1.9E+04	3.7E+04	**3.7E+04**	1
Copper	4.0E-02	4.0E-02	NA	Gastrointestinal	1.0E-02	NA	5.0E-03	1.4E-04		3.0E+02	1.5E+03	3.0E+03	**1.5E+03**	0.5
Iron	7.0E-01	7.0E-01	NA	Gastrointestinal	1.0E-02	NA	2.9E-04	8.0E-06		5.3E+03	2.7E+04	5.3E+04	**2.7E+04**	0.5
Manganese	2.4E-02	9.6E-04	5.0E-05	CNS	1.0E-02	NA	8.3E-03	5.8E-03	1.5E-05	1.1E+02	5.4E+02	1.1E+03	**5.4E+02**	0.5
Mercury	3.0E-04	2.1E-05	3.0E-04	Immune System	1.0E-02	NA	6.7E-01	2.7E-01	2.5E-06	1.7E+00	8.4E+00	1.7E+01	**8.4E+00**	0.5
Thallium	1.0E-05	1.0E-05	NA	Hair	1.0E-02	NA	2.0E+01	5.6E-01		7.6E-02	3.8E-01	7.6E-01	**3.8E-01**	0.5
Vanadium	5.0E-03	5.0E-03	NA	Hair	1.0E-02	NA	4.0E-02	1.1E-03		3.8E+01	1.9E+02	3.8E+02	**1.9E+02**	0.5

Noncarcinogenic calculations:

$$\textbf{Soil PRG (mg/kg)} = \frac{\text{Target HQ} \times AT_n}{EF \times ED \times (An/BW + Bn/BW + Cn)}$$

An = $1/RfDo \times IRS/10^6$ mg/kg

Bn = $1/RfDd \times SA \times AF \times ABS \times 1/10^6$ mg/kg

Cn = $1/RfC \times (1/PEF + 1/VF)$

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	15
ATnc - Averaging time for noncarcinogens (days)	2,190
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	350
ED - Exposure duration (year)	6
IRS - Ingestion rate (mg/day)	200
SA - Skin surface area (cm^2)	2,800
AF - Soil to Skin Adherence Factor (mg/cm^2-day)	0.2
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

1 Target HQ calculated so that total HQ for a target organ does not exceed 1.

VF - calculated on Table A-5a, only included in calculation for VOCs.

NA - Not available/Not applicable

Table A-5

Risk-Based Preliminary Remediation Goals
Child/Adult Residential Scenario (Carcinogenic) for OABG
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Oral Slope Factor (CSFo) (kg-day/mg)	Dermal Slope Factor (CSFd) (kg-day/mg)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Absorption Factor (ABS)	Volatilization Factor (VF) (m^3/kg)	Ac	Bc	Cn	Carcinogen Ingestion PRG Risk = 1E-06 (mg/kg)	Carcinogen Ingestion PRG Risk = 1E-05 (mg/kg)	Carcinogen Ingestion PRG Risk = 1E-04 (mg/kg)
VOCs											
Tetrachloroethene	2.1E-03	2.1E-03	2.6E-07	1.0E-02	2.1E+03	2.4E-07	7.6E-09	3.1E-06	2.2E+01	2.2E+02	2.2E+03
Trichloroethene[1]	4.6E-02	4.6E-02	4.1E-06	1.0E-02	2.7E+03	7.9E-03	2.3E-04	4.0E-02	5.3E-01	5.3E+00	5.3E+01
SVOCs											
Benzo(a)anthracene[1]	7.3E-01	7.3E-01	1.1E-04	1.3E-01	NA	1.3E-01	4.8E-02	2.2E-06	1.5E-01	1.5E+00	1.5E+01
Benzo(a)pyrene[1]	7.3E+00	7.3E+00	1.1E-03	1.3E-01	NA	1.3E+00	4.8E-01	2.2E-05	1.5E-02	1.5E-01	1.5E+00
Benzo(b)fluoranthene[1]	7.3E-01	7.3E-01	1.1E-04	1.3E-01	NA	1.3E-01	4.8E-02	2.2E-06	1.5E-01	1.5E+00	1.5E+01
Benzo(k)fluoranthene[1]	7.3E-02	7.3E-02	1.1E-04	1.3E-01	NA	1.3E-02	4.8E-03	2.2E-06	1.5E+00	1.5E+01	1.5E+02
Dibenz(a,h)anthracene[1]	7.3E+00	7.3E+00	1.2E-03	1.3E-01	NA	1.3E+00	4.8E-01	2.4E-05	1.5E-02	1.5E-01	1.5E+00
Indeno(1,2,3-cd)pyrene[1]	7.3E-01	7.3E-01	1.1E-04	1.3E-01	NA	1.3E-01	4.8E-02	2.2E-06	1.5E-01	1.5E+00	1.5E+01
Dioxins/Furans											
2,3,7,8-TCDD (dioxin)	1.3E+05	1.3E+05	3.8E+01	3.0E-02	NA	1.5E+01	1.4E+00	8.6E-04	4.5E-06	4.5E-05	4.5E-04
Inorganics											
Antimony	NA	NA									
Arsenic	1.5E+00	1.5E+00	4.3E-03	3.0E-02	NA	1.7E-04	1.6E-05	9.8E-08	3.9E-01	3.9E+00	3.9E+01
Cadmium	NA	NA	1.8E-03	1.0E-02	NA			4.1E-08	1.8E+03	1.8E+04	1.8E+05
Chromium (III)	NA	NA									
Copper	NA	NA									
Iron	NA	NA									
Manganese	NA	NA									
Mercury	NA	NA									
Thallium	NA	NA									
Vanadium	NA	NA									

Carcinogen calculations (for all chemicals except those that act via a mutagenic mode of action):

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{EF \times (Ac + Bc + Cc)}$$

Ac = CSFo x IRS/10^6 mg/kg

Bc = CSFd x DA-adj x ABS x 1/10^6 mg/kg

Cc = IUR x 1000 ug/mg x (1/VF + 1/PEF) x ED x ET x 1 day/24 hours

Carcinogen calculations (for chemicals that act via a mutagenic mode of action):

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{Ac + Bc + Cc}$$

Ac = CSFo x EF x IFSMadj x 1/10^6 mg/kg

Bc = CSFd x EF x $DFSM_{adj}$ x ABS x 1/10^6 mg/kg

Cc = see Table A-5b

EXPOSURE ASSUMPTIONS	
ATc - Averaging time for carcinogens (days)	25550
EF - Exposure frequency (days/year)	350
ED - Exposure duration (year)	30
ET - Exposure time (hour/day)	24
IRS - Ingestion rate (mg-year/kg-day)	114
IFSMadj - Mutagenic resident soil ingestion rate[2] (mg-year/kg-day)	489.5
DA-adj - Skin surface area (mg-year/kg-day)	361
DFSMadj - Mutagenic resident soil dermal contact factor (mg-year/kg-day)	1445
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - Not available/Not applicable
VF - calculated on Table A-5a, only included in calculation for VOCs.
1 - chemical acts via mutagenic mode of action

Table A-5a

Calculation of Chemical Specific Volatilization Factors

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Diffusivity in Air (D_i) (cm^2/s)	Henry's Law Constant (H') (unitless)	Diffusivity in Water (D_w) (cm^2/s)	Soil Organic Carbon Partition Coeff. (K_{oc}) (cm^3/g)	Soil Water Partition Coeff. ($K_d = K_{oc} \times F_{oc}$) ($g/cm^3$)	Solubility in Water (S) (mg/L)	Apparent Diffusivity (D_A) (cm^2/s)	Volatilization Factor (VF) (m^3/kg)
Volatile Organics								
Tetrachloroethene	7.20E-02	7.54E-01	8.20E-06	1.55E+02	9.30E-01	2.00E+02	2.47E-03	2.13E+03
Trichloroethene	7.90E-02	4.22E-01	9.10E-06	1.66E+02	9.96E-01	1.10E+03	1.51E-03	2.72E+03

Volatilization factor (VF) = (m^3/kg)

$$VF = \frac{Q/C_{vol} * (3.14 * D_A * T)^{1/2} * 10^{-4}\ (m^2/cm^2)}{2 * r_b * D_A}$$

Apparent Diffusivity (D_A) = (cm^2/s)

$$D_A = \frac{[(Q_a^{10/3} * D_i * H' + Q_w^{10/3} * D_w)/n^2]}{(r_b * K_d + Q_w + Q_a * H')}$$

oil Saturation Concentration (C_{sat}) = (mg/kg)

$$C_{sat} = S/r_b * (K_d * r_b + Q_w + H' * Q_a)$$

Parameters	Values
Q/C_{vol} - Inverse of the geometric mean air concentration to the volatilization flux at the center of a 0.5-acre-square source (g/m2-s per kg/m3) for Huntington, WV	58.17
T - Exposure interval(s)	9.5E+08
r_b - Soil bulk density (g/cm^3)	1.5
Q_a - Air-filled soil porosity (L_{air}/L_{soil}) = n - Q_w	0.28
n - Total soil porosity (L_{pore}/L_{soil}) = 1 - (r_b/r_s)	0.43
Q_w - Water-filled soil porosity (L_{water}/L_{soil})	0.15
r_s - Soil particle density (g/cm^3)	2.65
f_{oc} - fraction organic carbon in soil (g/g)	0.006

NA = Not available

Chemical and physical properties from USEPA, 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24.

Table A-5b

Calculation of Inhalation Factor for Risk-Based Preliminary Remediation Goals For COCs With Mutagenic Mode of Action
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Exposure Route	Chemical	IUR $(ug/m^3)^{-1}$	C_{0-2} 0-2 yrs	C_{2-6} 2-6 yrs	C_{6-16} 6-16 years	C_{16-30} 16-30 yrs	Cc
Inhalation	Trichloroethene	4.1E-06	8.2E-05	4.9E-05	1.2E-04	5.7E-05	4.0E-02
	Benzo(a)anthracene	1.1E-04	2.2E-03	1.3E-03	3.3E-03	1.5E-03	2.2E-06
	Benzo(a)pyrene	1.1E-03	2.2E-02	1.3E-02	3.3E-02	1.5E-02	2.2E-05
	Benzo(b)fluoranthene	1.1E-04	2.2E-03	1.3E-03	3.3E-03	1.5E-03	2.2E-06
	Benzo(k)fluoranthene	1.1E-04	2.2E-03	1.3E-03	3.3E-03	1.5E-03	2.2E-06
	Dibenz(a,h)anthracene	1.2E-03	2.4E-02	1.4E-02	3.6E-02	1.7E-02	2.4E-05
	Indeno(1,2,3-cd)pyrene	1.1E-04	2.2E-03	1.3E-03	3.3E-03	1.5E-03	2.2E-06

Equations

$\mathbf{C_{0-2}} = ED_{0-2} \times IUR \times 10$

$\mathbf{C_{2-6}} = ED_{2-6} \times IUR \times 3$

$\mathbf{C_{6-16}} = ED_{6-16} \times IUR \times 3$

$\mathbf{C_{16-30}} = ED1_{6-30} \times IUR \times 1$

$\mathbf{Cc} = EF \times ET \times 1\ day/24\ hours \times 1000\ ug/mg \times (C_{0-2} + C_{2-6} + C_{6-16} + C_{16-30}) \times (1/PEF\ + 1/VF)$

EXPOSURE ASSUMPTIONS	
EF - Exposure frequency (days/year)	350
ED_{0-2} - Exposure duration (year)	2
ED_{2-6} - Exposure duration (year)	4
ED_{6-16} - Exposure duration (year)	10
ED_{16-30} - Exposure duration (year)	14
ET - Exposure Time (hours/day)	24
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09
VF - Volitilization Factor (m^3/kg)	see Table A-5a

Table A-6

Human Health Risk-Based Preliminary Remediation Goals

Child Residential Scenario (Noncarcinogenic) for FDP

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Chronic Oral RfD (RfDo) (mg/kg-day)	Chronic Dermal RfD (RfDd) (mg/kg-day)	Chronic Inhalation RfC (RfC) (mg/m³)	Target Organ	Absorption Factor (ABS)	Volatilization Factor (VF) (m³/kg)	An	Bn	Cn	Noncarcinogen PRG HQ = 0.1 (mg/kg)	HQ = 0.5 (mg/kg)	HQ = 1 (mg/kg)	PRG (mg/kg)	Target HQ[1] (mg/kg)
VOCs														
Trichloroethene	5.0E-04	5.0E-04	2.0E-03	Development and Adult Immunotoxicity, Fetal Cardiac	1.0E-02	2.7E+03	4.0E-01	1.1E-02	1.8E-01	4.9E-01	2.5E+00	4.9E+00	**2.5E+00**	0.5
Dioxins/Furans														
2,3,7,8-TCDD (dioxin)	7.0E-10	7.0E-10	4.0E-08	Sperm, Developmental, Liver, Development, Endocrine	3.0E-02	NA	2.9E+05	2.4E+04	1.9E-02	5.1E-06	2.5E-05	5.1E-05	**2.5E-05**	0.5
Inorganics														
Arsenic	3.0E-04	3.0E-04	1.5E-05	Skin, Vascular	3.0E-02	NA	6.7E-01	5.6E-02	5.1E-05	2.2E+00	1.1E+01	2.2E+01	**2.2E+01**	1
Iron	7.0E-01	7.0E-01	NA	Gastrointestinal	1.0E-02	NA	2.9E-04	8.0E-06	NA	5.3E+03	2.7E+04	5.3E+04	**5.3E+04**	1
Manganese	2.4E-02	9.6E-04	5.0E-05	CNS	1.0E-02	NA	8.3E-03	5.8E-03	1.5E-05	1.1E+02	5.4E+02	1.1E+03	**1.1E+03**	1
Thallium	1.0E-05	1.0E-05	NA	Hair	1.0E-02	NA	2.0E+01	5.6E-01	NA	7.6E-02	3.8E-01	7.6E-01	**3.8E-01**	0.5
Vanadium	5.0E-03	5.0E-03	NA	Hair	1.0E-02	NA	4.0E-02	1.1E-03	NA	3.8E+01	1.9E+02	3.8E+02	**1.9E+02**	0.5

Noncarcinogenic calculations:

$$\textbf{Soil PRG (mg/kg)} = \frac{\text{Target HQ} \times AT_n}{EF \times ED \times (An/BW + Bn/BW + Cn)}$$

An = $1/RfDo \times IRS/10^6$ mg/kg

Bn = $1/RfDd \times SA \times AF \times ABS \times 1/10^6$ mg/kg

Cn = $1/RfC \times (1/PEF + 1/VF)$

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	15
ATnc - Averaging time for noncarcinogens (days)	2,190
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	350
ED - Exposure duration (year)	6
IRS - Ingestion rate (mg/day)	200
SA - Skin surface area (cm^2)	2,800
AF - Soil to Skin Adherence Factor (mg/cm^2-day)	0.2
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

1 Target HQ calculated so that total HQ for a target organ does not exceed 1.

VF - calculated on Table A-5a, only included in calculation for VOCs.

NA - Not available/Not applicable

Table A-7
Human Health Risk-Based Preliminary Remediation Goals
Child/Adult Residential Scenario (Carcinogenic) for FDP
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Oral Slope Factor (CSFo) (kg-day/mg)	Dermal Slope Factor (CSFd) (kg-day/mg)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Absorption Factor (ABS)	Volatilization Factor (VF) (m^3/kg)	Ac	Bc	Cc	Carcinogen Ingestion PRG Risk = 1E-06 (mg/kg)	Risk = 1E-05 (mg/kg)	Risk = 1E-04 (mg/kg)
VOCs											
Trichloroethene[1]	4.6E-02	4.6E-02	4.1E-06	1.0E-02	2.7E+03	7.9E-03	2.3E-04	4.0E-02	5.3E-01	5.3E+00	5.3E+01
Dioxins/Furans											
2,3,7,8-TCDD (dioxin)	1.3E+05	1.3E+05	3.8E+01	3.0E-02	NA	1.5E+01	1.4E+00	8.6E-04	4.5E-06	4.5E-05	4.5E-04
Inorganics											
Arsenic	1.5E+00	1.5E+00	4.3E-03	3.0E-02	NA	1.7E-04	1.6E-05	9.8E-08	3.9E-01	3.9E+00	3.9E+01
Iron	NA	NA	NA								
Manganese	NA	NA	NA								
Thallium	NA	NA	NA								
Vanadium	NA	NA	NA								

Carcinogen calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{EF \times (Ac + Bc + Cc)}$$

Ac = $CSFo \times IRS/10^6$ mg/kg

Bc = $CSFd \times DA\text{-}adj \times ABS \times 1/10^6$ mg/kg

Cc = IUR x 1000 ug/mg x (1/VF + 1/PEF) x ED x ET x 1 day/24 hours

Carcinogen calculations (for chemicals that act via a mutagenic mode of action):

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{Ac + Bc + Cc}$$

Ac = $CSFo \times EF \times IFSMadj \times 1/10^6$ mg/kg

Bc = $CSFd \times EF \times DFSM_{adj} \times ABS \times 1/10^6$ mg/kg

Cc = see Table A-5b

EXPOSURE ASSUMPTIONS	
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	350
ED - Exposure duration (year)	30
ET - Exposure time (hour/day)	24
IRS - Ingestion rate (mg-year/kg-day)	114
IFSMadj - Mutagenic resident soil ingestion rate[2] (mg-year/kg-day)	489.5
DA-adj - Skin surface area (mg-year/kg-day)	361
DFSMadj - Mutagenic resident soil dermal contact factor (mg-year/kg-day)	1445
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - Not available/Not applicable
VF - calculated on Table A-5a, only included in calculation for VOCs.
1 - chemical acts via mutagenic mode of action

Table A-8

Human Health Risk-Based Preliminary Remediation Goals

Child Residential Scenario (Noncarcinogenic) for ABG

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Chronic Oral RfD (RfDo) (mg/kg-day)	Chronic Dermal RfD (RfDd) (mg/kg-day)	Chronic Inhalation RfC (RfC) (mg/m^3)	Target Organ	Absorption Factor (ABS)	An	Bn	Cn	Noncarcinogen PRG HQ = 0.1 (mg/kg)	HQ = 0.5 (mg/kg)	HQ = 1 (mg/kg)	PRG (mg/kg)	Target HQ[1] (mg/kg)
Explosives													
Perchlorate	7.0E-04	7.0E-04	NA	Thyroid	1.0E-02	2.9E-01	8.0E-03	NA	5.3E+00	2.7E+01	5.3E+01	**5.3E+01**	1
Inorganics													
Arsenic	3.0E-04	3.0E-04	1.5E-05	Skin, Vascular	3.0E-02	6.7E-01	5.6E-02	5.1E-05	2.2E+00	1.1E+01	2.2E+01	**2.2E+01**	1
Iron	7.0E-01	7.0E-01	NA	Gastrointestinal	1.0E-02	2.9E-04	8.0E-06	NA	5.3E+03	2.7E+04	5.3E+04	**5.3E+04**	1
Manganese	2.4E-02	9.6E-04	5.0E-05	CNS	1.0E-02	8.3E-03	5.8E-03	1.5E-05	1.1E+02	5.4E+02	1.1E+03	**1.1E+03**	1
Thallium	1.0E-05	1.0E-05	NA	Hair	1.0E-02	2.0E+01	5.6E-01	NA	7.6E-02	3.8E-01	7.6E-01	**3.8E-01**	0.5
Vanadium	5.0E-03	5.0E-03	NA	Hair	1.0E-02	4.0E-02	1.1E-03	NA	3.8E+01	1.9E+02	3.8E+02	**1.9E+02**	0.5

Noncarcinogenic calculations:

$$\textbf{Soil PRG (mg/kg)} = \frac{\text{Target HQ x AT}_n}{\text{EF x ED x (An/BW + Bn/BW + Cn)}}$$

An = $1/RfDo \times IRS/10^6$ mg/kg

Bn = $1/RfDd \times SA \times AF \times ABS \times 1/10^6$ mg/kg

Cn = $1/RfC \times (1/PEF)$

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	15
ATnc - Averaging time for noncarcinogens (days)	2,190
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	350
ED - Exposure duration (year)	6
IRS - Ingestion rate (mg/day)	200
SA - Skin surface area (cm^2)	2,800
AF - Soil to Skin Adherence Factor (mg/cm^2-day)	0.2
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

1 Target HQ calculated so that total HQ for a target organ does not exceed 1.

NA - Not available/Not applicable

TableA-9

Human Health Risk-Based Preliminary Remediation Goals

Child/Adult Residential Scenario (Carcinogenic) for ABG

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Oral Slope Factor (CSFo) (kg-day/mg)	Dermal Slope Factor (CSFd) (kg-day/mg)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Absorption Factor (ABS)	Volatilization Factor (VF) (m^3/kg)	Ac	Bc	Cc	Carcinogen Ingestion PRG Risk = 1E-06 (mg/kg)	Risk = 1E-05 (mg/kg)	Risk = 1E-04 (mg/kg)
Explosives											
Perchlorate	NA	NA	NA								
Inorganics											
Arsenic	1.5E+00	1.5E+00	4.3E-03	3.0E-02	NA	1.7E-04	1.6E-05	9.8E-08	3.9E-01	3.9E+00	3.9E+01
Iron	NA	NA	NA								
Manganese	NA	NA	NA								
Thallium	NA	NA	NA								
Vanadium	NA	NA	NA								

Carcinogen calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{EF \times (Ac + Bc + Cc)}$$

Ac = CSFo x IRS/10^6 mg/kg

Bc = CSFd x DA-adj x ABS x 1/10^6 mg/kg

Cc = IUR x 1000 ug/mg x (1/PEF) x ED x ET x 1 day/24 hours

EXPOSURE ASSUMPTIONS	
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	350
ED - Exposure duration (year)	30
ET - Exposure time (hour/day)	24
IRS - Ingestion rate (mg-year/kg-day)	114
DA-adj - Skin surface area (mg-year/kg-day)	361
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - Not available/Not applicable

Table A-10

Recommended Human Health Risk-Based Preliminary Remediation Goals for Soil

Residential Scenario

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	OABG		FDP		ABG	
	Recommended Soil PRG (mg/kg)	Basis	Recommended Soil PRG (mg/kg)	Basis	Recommended Soil PRG (mg/kg)	Basis
VOCs						
Tetrachloroethene	3.7E+01	Child, HQ=0.5				
Trichloroethene	2.5E+00	Child, HQ=0.5	2.5E+00	Child, HQ=0.5		
SVOCs						
Benzo(a)anthracene	1.5E+00	Lifetime, CR = 10^{-5}				
Benzo(a)pyrene	1.5E-01	Lifetime, CR = 10^{-5}				
Benzo(b)fluoranthene	1.5E+00	Lifetime, CR = 10^{-5}				
Benzo(k)fluoranthene	1.5E+01	Lifetime, CR = 10^{-5}				
Dibenz(a,h)anthracene	1.5E-01	Lifetime, CR = 10^{-5}				
Indeno(1,2,3-cd)pyrene	1.5E+00	Lifetime, CR = 10^{-5}				
Dioxins/Furans						
2,3,7,8-TCDD (dioxin)	2.5E-05	Child, HQ=0.5	2.5E-05	Child, HQ=0.5		
Explosives						
Perchlorate					5.3E+01	Child, HQ=1
Inorganics						
Antimony	2.6E+01	Child, HQ=1				
Arsenic	3.9E+00	Lifetime, CR = 10^{-5}	3.9E+00	Lifetime, CR = 10^{-5}	3.9E+00	Lifetime, CR = 10^{-5}
Cadmium	7.0E+01	Child, HQ=1				
Chromium (III)	3.7E+04	Child, HQ=1				
Copper	1.5E+03	Child, HQ=0.5				
Iron	2.7E+04	Child, HQ=0.5	5.3E+04	Child, HQ=1	5.3E+04	Child, HQ=1
Manganese	5.4E+02	Child, HQ=0.5	1.1E+03	Child, HQ=1	1.1E+03	Child, HQ=1
Mercury	8.4E+00	Child, HQ=0.5				
Thallium	3.8E-01	Child, HQ=0.5	3.8E-01	Child, HQ=0.5	3.8E-01	Child, HQ=0.5
Vanadium	1.9E+02	Child, HQ=0.5	1.9E+02	Child, HQ=0.5	1.9E+02	Child, HQ=0.5

Notes:

1. For constituents with basis of CR = 10^{-5}, PRG for CR =10^{-5} less than PRG for applicable HQ.
2. Used CR of 10^{-5} to keep overall carcinogenic risk equal to or below 10^{-4}.
3. Applicable HQ chosen to keep total HI for each target organ equal to or less than 1.

Table A-11

Human Health Risk-Based Preliminary Remediation Goals

Industrial Worker Scenario (Noncarcinogenic) for OABG

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Chronic Oral RfD (RfDo) (mg/kg-day)	Chronic Dermal RfD (RfDd) (mg/kg-day)	Chronic Inhalation RfC (RfC) (mg/m^3)	Target Organ	Absorption Factor (ABS) (unitless)	Volatilization Factor (VF) (m^3/kg)	An	Bn	Cn	Noncarcinogen PRG HQ = 0.1 (mg/kg)	Noncarcinogen PRG HQ = 0.5 (mg/kg)	Noncarcinogen PRG HQ = 1 (mg/kg)	PRG (mg/kg)	Target HQ[1] (mg/kg)
VOCs														
Tetrachloroethene	6.0E-03	6.0E-03	4.0E-02	Neurological	1.0E-02	2.1E+03	1.7E-02	1.1E-03	1.2E-02	1.2E+01	6.1E+01	1.2E+02	**6.1E+01**	0.5
Trichloroethene	5.0E-04	5.0E-04	2.0E-03	Development and Adult Immunotoxicity, Fetal Cardiac	1.0E-02	2.7E+03	2.0E-01	1.3E-02	1.8E-01	7.8E-01	3.9E+00	7.8E+00	**3.9E+00**	0.5
SVOCs														
Benzo(a)anthracene	NA	NA	NA		1.3E-01									
Benzo(a)pyrene	NA	NA	NA		1.3E-01									
Benzo(b)fluoranthene	NA	NA	NA		1.3E-01									
Benzo(k)fluoranthene	NA	NA	NA		1.3E-01									
Dibenz(a,h)anthracene	NA	NA	NA		1.3E-01									
Indeno(1,2,3-cd)pyrene	NA	NA	NA		1.3E-01									
Dioxins/Furans														
2,3,7,8-TCDD (dioxin)	7.0E-10	7.0E-10	4.0E-08	Sperm, Developmental, Liver, Development, Endocrine	3.0E-02	NA	1.4E+05	2.8E+04	1.9E-02	6.0E-05	3.0E-04	6.0E-04	**3.0E-04**	0.5
Inorganics														
Antimony	4.0E-04	6.0E-05	NA	Longevitiy, Blood	1.0E-02	NA	2.5E-01	1.1E-01	NA	2.8E+01	1.4E+02	2.8E+02	**2.8E+02**	1
Arsenic	3.0E-04	3.0E-04	1.5E-05	Skin, Vascular	3.0E-02	NA	3.3E-01	6.6E-02	5.1E-05	2.5E+01	1.3E+02	2.5E+02	**2.5E+02**	1
Cadmium	1.0E-03	2.5E-05	2.0E-05	Kidney	1.0E-03	NA	1.0E-01	2.6E-02	3.8E-05	7.9E+01	4.0E+02	7.9E+02	**7.9E+02**	1
Chromium (III)	1.5E+00	2.0E-02	NA	Not identified	1.0E-02	NA	6.7E-05	3.4E-04	NA	2.5E+04	1.3E+05	2.5E+05	**2.5E+05**	1
Copper	4.0E-02	4.0E-02	NA	Gastrointestinal	1.0E-02	NA	2.5E-03	1.7E-04	NA	3.8E+03	1.9E+04	3.8E+04	**1.9E+04**	0.5
Iron	7.0E-01	7.0E-01	NA	Gastrointestinal	1.0E-02	NA	1.4E-04	9.4E-06	NA	6.7E+04	3.4E+05	6.7E+05	**3.4E+05**	0.5
Manganese	2.4E-02	9.6E-04	5.0E-05	CNS	1.0E-02	NA	4.2E-03	6.9E-03	1.5E-05	8.4E+02	4.2E+03	8.4E+03	**4.2E+03**	0.5
Mercury	3.0E-04	2.1E-05	3.0E-04	Immune System	1.0E-02	NA	3.3E-01	3.1E-01	2.5E-06	1.6E+01	7.9E+01	1.6E+02	**7.9E+01**	0.5
Thallium	1.0E-05	1.0E-05	NA	Hair	1.0E-02	NA	1.0E+01	6.6E-01	NA	9.6E-01	4.8E+00	9.6E+00	**4.8E+00**	0.5
Vanadium	5.0E-03	5.0E-03	NA	Hair	1.0E-02	NA	2.0E-02	1.3E-03	NA	4.8E+02	2.4E+03	4.8E+03	**2.4E+03**	0.5

Noncarcinogenic calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{\text{Target HQ} \times AT_n}{EF \times ED \times (An/BW + Bn/BW + Cn)}$$

An = $1/RfDo \times IRS/10^6$ mg/kg

Bn = $1/RfDd \times SA \times AF \times ABS \times 1/10^6$ mg/kg

Cn = $1/RfC \times (1/PEF + 1/VF)$

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATnc - Averaging time for noncarcinogens (days)	9,125
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	25
ET - Exposure Time (hours/day)	8
IRS - Ingestion rate (mg/day)	100
SSA - Skin surface area (m^3)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2)	0.2
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - Not available/Not applicable

VF - calculated on Table A-5a, only included in calculation for VOCs.

ABS from EPA's *Risk Assessment Guidance for Superfund Volume 1: Human health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)*. EPA/540/R/99/005. July 2004.

Table A-12
Human Health Risk-Based Preliminary Remediation Goals
Industrial Worker Scenario (Carcinogenic) for OABG
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Oral Slope Factor (CSFo) (kg-day/mg)	Dermal Slope Factor (CSFd) (kg-day/mg)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Absorption Factor (ABS) (unitless)	Volatilization Factor (VF) (m^3/kg)	Ac	Bc	Cc	Carcinogen PRG Risk = 1E-06 (mg/kg)	Carcinogen PRG Risk = 1E-05 (mg/kg)	Carcinogen PRG Risk = 1E-04 (mg/kg)
VOCs											
Tetrachloroethene	2.1E-03	2.1E-03	2.6E-07	1.0E-02	2.1E+03	3.0E-09	2.0E-10	4.1E-08	9.3E+01	9.3E+02	9.3E+03
Trichloroethene	4.6E-02	4.6E-02	4.1E-06	1.0E-02	2.7E+03	6.6E-08	4.3E-09	5.0E-07	7.1E+00	7.1E+01	7.1E+02
SVOCs											
Benzo(a)anthracene	7.3E-01	7.3E-01	1.1E-04	1.3E-01		1.0E-06	8.9E-07	2.8E-11	2.1E+00	2.1E+01	2.1E+02
Benzo(a)pyrene	7.3E+00	7.3E+00	1.1E-03	1.3E-01		1.0E-05	8.9E-06	2.8E-10	2.1E-01	2.1E+00	2.1E+01
Benzo(b)fluoranthene	7.3E-01	7.3E-01	1.1E-04	1.3E-01		1.0E-06	8.9E-07	2.8E-11	2.1E+00	2.1E+01	2.1E+02
Benzo(k)fluoranthene	7.3E-02	7.3E-02	1.1E-04	1.3E-01		1.0E-07	8.9E-08	2.8E-11	2.1E+01	2.1E+02	2.1E+03
Dibenz(a,h)anthracene	7.3E+00	7.3E+00	1.2E-03	1.3E-01		1.0E-05	8.9E-06	3.0E-10	2.1E-01	2.1E+00	2.1E+01
Indeno(1,2,3-cd)pyrene	7.3E-01	7.3E-01	1.1E-04	1.3E-01		1.0E-06	8.9E-07	2.8E-11	2.1E+00	2.1E+01	2.1E+02
Dioxins/Furans											
2,3,7,8-TCDD (dioxin)	1.3E+05	1.3E+05	3.8E+01	3.0E-02		1.9E-01	3.7E-02	9.6E-06	1.8E-05	1.8E-04	1.8E-03
Inorganics											
Antimony	NA	NA	NA	1.0E-02							
Arsenic	1.5E+00	1.5E+00	4.3E-03	3.0E-02		2.1E-06	4.2E-07	1.1E-09	1.6E+00	1.6E+01	1.6E+02
Cadmium	NA	NA	1.8E-03	1.0E-03		NA	NA	4.5E-10	9.0E+03	9.0E+04	9.0E+05
Chromium (III)	NA	NA	NA	1.0E-02							
Copper	NA	NA	NA	1.0E-02							
Iron	NA	NA	NA	1.0E-02							
Manganese	NA	NA	NA	1.0E-02							
Mercury	NA	NA	NA	1.0E-02							
Thallium	NA	NA	NA	1.0E-02							
Vanadium	NA	NA	NA	1.0E-02							

Carcinogen calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{EF \times ED \times (Ac + Bc + Cc)}$$

Ac = $CSFo \times IRS/10^6$ mg/kg x 1/BW

Bc = $CSFd \times SSA \times AF \times ABS \times 1/10^6$ mg/kg x 1/BW

Cc = IUR x 1000 ug/mg x (1/VF + 1/PEF) x ET x 1 day/24 hours

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATnc - Averaging time for noncarcinogens (days)	9,125
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	25
ET - Exposure Time (hours/day)	8
IRS - Ingestion rate (mg/day)	100
SSA - Skin surface area (m^3)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2)	0.2
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - Not available/Not applicable

VF - calculated on Table A-5a, only included in calculation for VOCs.

ABS from EPA's *Risk Assessment Guidance for Superfund Volume 1: Human health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment*). EPA/540/R/99/005. July 2004.

Table A-13

Human Health Risk-Based Preliminary Remediation Goals

Industrial Worker Scenario (Noncarcinogenic) for FDP

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Chronic Oral RfD (RfDo) (mg/kg-day)	Chronic Dermal RfD (RfDd) (mg/kg-day)	Chronic Inhalation RfC (RfC) (mg/m^3)	Target Organ	Absorption Factor (ABS) (unitless)	Volatilization Factor (VF) (m^3/kg)	An	Bn	Cn	Noncarcinogen PRG HQ = 0.1 (mg/kg)	HQ = 0.5 (mg/kg)	HQ = 1 (mg/kg)	PRG (mg/kg)	Target HQ[1] (mg/kg)
VOCs														
Trichloroethene	5.0E-04	5.0E-04	2.0E-03	Development and Adult Immunotoxicity, Fetal Cardiac	1.0E-02	2.7E+03	2.0E-01	1.3E-02	1.8E-01	7.8E-01	3.9E+00	7.8E+00	**3.9E+00**	0.5
Dioxins/Furans														
2,3,7,8-TCDD (dioxin)	7.0E-10	7.0E-10	4.0E-08	Sperm, Developmental, Liver, Development, Endocrine	3.0E-02	NA	1.4E+05	2.8E+04	1.9E-02	6.0E-05	3.0E-04	6.0E-04	**3.0E-04**	0.5
Inorganics														
Arsenic	3.0E-04	3.0E-04	1.5E-05	Skin, Vascular	3.0E-02	NA	3.3E-01	6.6E-02	5.1E-05	2.5E+01	1.3E+02	2.5E+02	**2.5E+02**	1
Iron	7.0E-01	7.0E-01	NA	Gastrointestinal	1.0E-02	NA	1.4E-04	9.4E-06	NA	6.7E+04	3.4E+05	6.7E+05	**6.7E+05**	1
Manganese	2.4E-02	9.6E-04	5.0E-05	CNS	1.0E-02	NA	4.2E-03	6.9E-03	1.5E-05	8.4E+02	4.2E+03	8.4E+03	**8.4E+03**	1
Thallium	1.0E-05	1.0E-05	NA	Hair	1.0E-02	NA	1.0E+01	6.6E-01	NA	9.6E-01	4.8E+00	9.6E+00	**4.8E+00**	0.5
Vanadium	5.0E-03	5.0E-03	NA	Hair	1.0E-02	NA	2.0E-02	1.3E-03	NA	4.8E+02	2.4E+03	4.8E+03	**2.4E+03**	0.5

Noncarcinogenic calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{\text{Target HQ} \times AT_n}{EF \times ED \times (An/BW + Bn/BW + Cn)}$$

An = $1/RfDo \times IRS/10^6$ mg/kg

Bn = $1/RfDd \times SA \times AF \times ABS \times 1/10^6$ mg/kg

Cn = $1/RfC \times (1/PEF + 1/VF)$

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATnc - Averaging time for noncarcinogens (days)	9,125
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	25
ET - Exposure Time (hours/day)	8
IRS - Ingestion rate (mg/day)	100
SSA - Skin surface area (m^3)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2)	0.2
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

VF - calculated on Table A-5a, only included in calculation for VOCs.

NA - Not available/Not applicable

Table A-14

Human Health Risk-Based Preliminary Remediation Goals

Industrial Worker Scenario (Carcinogenic) for FDP

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Oral Slope Factor (CSFo) (kg-day/mg)	Dermal Slope Factor (CSFd) (kg-day/mg)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Absorption Factor (ABS) (unitless)	Volatilization Factor (VF) (m^3/kg)	Ac	Bc	Cc	Carcinogen PRG		
									Risk = 1E-06 (mg/kg)	Risk = 1E-05 (mg/kg)	Risk = 1E-04 (mg/kg)
VOCs											
Trichloroethene	4.6E-02	4.6E-02	4.1E-06	1.0E-02	2.7E+03	6.6E-08	4.3E-09	5.0E-07	7.1E+00	7.1E+01	7.1E+02
Dioxins/Furans											
2,3,7,8-TCDD (dioxin)	1.3E+05	1.3E+05	3.8E+01	3.0E-02		1.9E-01	3.7E-02	9.6E-06	1.8E-05	1.8E-04	1.8E-03
Inorganics											
Arsenic	1.5E+00	1.5E+00	4.3E-03	3.0E-02		2.1E-06	4.2E-07	1.1E-09	1.6E+00	1.6E+01	1.6E+02
Iron	NA	NA	NA	1.0E-02							
Manganese	NA	NA	NA	1.0E-02							
Thallium	NA	NA	NA	1.0E-02							
Vanadium	NA	NA	NA	1.0E-02							

Carcinogen calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{EF \times ED \times (Ac + Bc + Cc)}$$

Ac = CSFo x IRS/10^6 mg/kg x 1/BW

Bc = CSFd x SSA x AF x ABS x 1/10^6 mg/kg x 1/BW

Cc = IUR x 1000 ug/mg x (1/VF + 1/PEF) x ET x 1 day/24 hours

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATnc - Averaging time for noncarcinogens (days)	9,125
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	25
ET - Exposure Time (hours/day)	8
IRS - Ingestion rate (mg/day)	100
SSA - Skin surface area (m^3)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2)	0.2
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - Not available/Not applicable

VF - calculated on Table A-5a, only included in calculation for VOCs.

Table A-15
Human Health Risk-Based Preliminary Remediation Goals
Industrial Worker Scenario (Noncarcinogenic) for ABG
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Chronic Oral RfD (RfDo) (mg/kg-day)	Chronic Dermal RfD (RfDd) (mg/kg-day)	Chronic Inhalation RfC (RfC) (mg/m^3)	Target Organ	Absorption Factor (ABS) (unitless)	An	Bn	Cn	Noncarcinogen PRG HQ = 0.1 (mg/kg)	HQ = 0.5 (mg/kg)	HQ = 1 (mg/kg)	PRG (mg/kg)	Target HQ[1] (mg/kg)
Explosives													
Perchlorate	7.0E-04	7.0E-04	NA	Thyroid	1.0E-02	1.4E-01	9.4E-03	NA	6.7E+01	3.4E+02	6.7E+02	**6.7E+02**	1
Inorganics													
Arsenic	3.0E-04	3.0E-04	1.5E-05	Skin, Vascular	3.0E-02	3.3E-01	6.6E-02	5.1E-05	2.5E+01	1.3E+02	2.5E+02	**2.5E+02**	1
Iron	7.0E-01	7.0E-01	NA	Gastrointestinal	1.0E-02	1.4E-04	9.4E-06	NA	6.7E+04	3.4E+05	6.7E+05	**6.7E+05**	1
Manganese	2.4E-02	9.6E-04	5.0E-05	CNS	1.0E-02	4.2E-03	6.9E-03	1.5E-05	8.4E+02	4.2E+03	8.4E+03	**8.4E+03**	1
Thallium	1.0E-05	1.0E-05	NA	Hair	1.0E-02	1.0E+01	6.6E-01	NA	9.6E-01	4.8E+00	9.6E+00	**4.8E+00**	0.5
Vanadium	5.0E-03	5.0E-03	NA	Hair	1.0E-02	2.0E-02	1.3E-03	NA	4.8E+02	2.4E+03	4.8E+03	**2.4E+03**	0.5

Noncarcinogenic calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{\text{Target HQ} \times AT_n}{EF \times ED \times (An/BW + Bn/BW + Cn)}$$

An = $1/RfDo \times IRS/10^6$ mg/kg

Bn = $1/RfDd \times SA \times AF \times ABS \times 1/10^6$ mg/kg

Cn = $1/RfC \times (1/PEF)$

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATnc - Averaging time for noncarcinogens (days)	9,125
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	25
ET - Exposure Time (hours/day)	8
IRS - Ingestion rate (mg/day)	100
SSA - Skin surface area (m^3)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2)	0.2
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - Not available/Not applicable

Table A-16
Human Health Risk-Based Preliminary Remediation Goals
Industrial Worker Scenario (Carcinogenic) for ABG
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Oral Slope Factor (CSFo) (kg-day/mg)	Dermal Slope Factor (CSFd) (kg-day/mg)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Absorption Factor (ABS) (unitless)	Volatilization Factor (VF) (m^3/kg)	Ac	Bc	Cc	Carcinogen PRG		
									Risk = 1E-06 (mg/kg)	Risk = 1E-05 (mg/kg)	Risk = 1E-04 (mg/kg)
Explosives											
Perchlorate	NA	NA	NA	1.0E-02							
Inorganics											
Arsenic	1.5E+00	1.5E+00	4.3E-03	3.0E-02		2.1E-06	4.2E-07	1.1E-09	1.6E+00	1.6E+01	1.6E+02
Iron	NA	NA	NA	1.0E-02							
Manganese	NA	NA	NA	1.0E-02							
Thallium	NA	NA	NA	1.0E-02							
Vanadium	NA	NA	NA	1.0E-02							

Carcinogen calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{EF \times ED \times (Ac + Bc + Cc)}$$

$$\textbf{Ac} = CSFo \times IRS/10^6 \text{ mg/kg} \times 1/BW$$

$$\textbf{Bc} = CSFd \times SSA \times AF \times ABS \times 1/10^6 \text{ mg/kg} \times 1/BW$$

$$\textbf{Cc} = IUR \times 1000 \text{ ug/mg} \times (1/VF + 1/PEF) \times ET \times 1 \text{ day/24 hours}$$

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATnc - Averaging time for noncarcinogens (days)	9,125
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	25
ET - Exposure Time (hours/day)	8
IRS - Ingestion rate (mg/day)	100
SSA - Skin surface area (m^3)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2)	0.2
ABS - Absorption Factor (unitless)	chemical specific
IRA - Inhalation Rate $(m^3/hour)$	0.83
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - Not available/Not applicable
VF - calculated on Table A-5a, only included in calculation for VOCs.

Table A-17
Human Health Risk-Based Preliminary Remediation Goals
Construction Worker Scenario (Noncarcinogenic) for OABG
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Subchronic Oral RfD (RfDo) (mg/kg-day)	Subchronic Dermal RfD (RfDd) (mg/kg-day)	Subchronic Inhalation RfC (RfC) (mg/m^3)	Target Organ	Absorption Factor (ABS)	Volatilization Factor (VF) (m^3/kg)	An	Bn	Cn	Noncarcinogen PRG HQ = 0.1 (mg/kg)	HQ = 0.5 (mg/kg)	HQ = 1 (mg/kg)	PRG (mg/kg)	Target HQ[1] (mg/kg)
VOCs														
Tetrachloroethene	1.0E-01	1.0E-01	4.0E-02	Liver	1.0E-02	2.1E+03	3.3E-03	9.9E-05	1.2E-02	1.2E+01	6.2E+01	1.2E+02	**1.2E+02**	1
Trichloroethene	5.0E-04	5.0E-04	5.4E-01	Development, Adult Immunotoxicity, Fetal Cardiac, Neurological	1.0E-02	2.7E+03	6.6E-01	2.0E-02	6.8E-04	1.4E+01	7.0E+01	1.4E+02	**7.0E+01**	0.5
SVOCs														
Benzo(a)anthracene	NA	NA	NA		1.3E-01									
Benzo(a)pyrene	NA	NA	NA		1.3E-01									
Benzo(b)fluoranthene	NA	NA	NA		1.3E-01									
Benzo(k)fluoranthene	NA	NA	NA		1.3E-01									
Dibenz(a,h)anthracene	NA	NA	NA		1.3E-01									
Indeno(1,2,3-cd)pyrene	NA	NA	NA		1.3E-01									
Dioxins/Furans														
2,3,7,8-TCDD (dioxin)	2.0E-08	2.0E-08	4.0E-08	Lymphatic	3.0E-02	NA	1.7E+04	1.5E+03	1.9E-02	5.7E-04	2.8E-03	5.7E-03	**5.7E-03**	1
Inorganics														
Antimony	4.0E-04	6.0E-05	NA	Blood	1.0E-02	NA	8.3E-01	1.7E-01	NA	1.0E+01	5.2E+01	1.0E+02	**1.0E+02**	1
Arsenic	3.0E-04	3.0E-04	1.5E-05	Skin, Vascular	3.0E-02	NA	1.1E+00	9.9E-02	5.1E-05	8.5E+00	4.2E+01	8.5E+01	**8.5E+01**	1
Cadmium	1.0E-03	2.5E-05	2.0E-05	Kidney	1.0E-02	NA	3.3E-01	4.0E-01	3.8E-05	1.4E+01	7.0E+01	1.4E+02	**1.4E+02**	1
Chromium (III)	1.5E+00	2.0E-02	NA	Not identified	1.0E-02	NA	2.2E-04	5.1E-04	NA	1.4E+04	7.0E+04	1.4E+05	**1.4E+05**	1
Copper	4.0E-02	4.0E-02	NA	Gastrointestinal	1.0E-02	NA	8.3E-03	2.5E-04	NA	1.2E+03	6.0E+03	1.2E+04	**6.0E+03**	0.5
Iron	7.0E-01	7.0E-01	NA	Gastrointestinal	1.0E-02	NA	4.7E-04	1.4E-05	NA	2.1E+04	1.1E+05	2.1E+05	**1.1E+05**	0.5
Manganese	2.4E-02	9.6E-04	5.0E-05	CNS	1.0E-02	NA	1.4E-02	1.0E-02	1.5E-05	4.1E+02	2.0E+03	4.1E+03	**2.0E+03**	0.5
Mercury	3.0E-04	2.1E-05	3.0E-04	Immune System	1.0E-02	NA	1.1E+00	4.7E-01	2.5E-06	6.5E+00	3.3E+01	6.5E+01	**6.5E+01**	1
Thallium	4.0E-05	4.0E-05	NA	Hair	1.0E-02	NA	8.3E+00	2.5E-01	NA	1.2E+00	6.0E+00	1.2E+01	**6.0E+00**	0.5
Vanadium	5.0E-03	5.0E-03	NA	Hair	1.0E-02	NA	6.6E-02	2.0E-03	NA	1.5E+02	7.5E+02	1.5E+03	**7.5E+02**	0.5

Noncarcinogenic calculations:

$$\textbf{Soil PRG (mg/kg)} = \frac{\text{Target HQ} \times AT_n}{EF \times ED \times (An/BW + Bn/BW + Cn)}$$

An = $1/RfDo \times IRS/10^6$ mg/kg

Bn = $1/RfDd \times SA \times AF \times ABS \times 1/10^6$ mg/kg

Cn = $1/RfC \times (1/PEF + 1/VF)$

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATnc - Averaging time for noncarcinogens (days)	365
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	1
IRS - Ingestion rate (mg/day)	330
SA - Skin surface area (cm^2)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2-day)	0.3
ABS - Absorption Factor (unitless)	chemical specific
IRA - Inhalation Rate (m^3/day)	20
ET -Exposure Time (hour/day)	8
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

VF - calculated on Table A-5a, only included in calculation for VOCs.

1 Target HQ calculated so that total HQ for a target organ does not exceed 1.

Table A-18

Human Health Risk-Based Preliminary Remediation Goals

Construction Worker Scenario (Carcinogenic) for OABG

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Oral Slope Factor (CSFo) (kg-day/mg)	Dermal Slope Factor (CSFd) (kg-day/mg)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Absorption Factor (ABS)	Volatilization Factor (VF)	Ac	Bc	Cc	Carcinogen Ingestion PRG Risk = 1E-06 (mg/kg)	Risk = 1E-05 (mg/kg)	Risk = 1E-04 (mg/kg)
VOCs											
Tetrachloroethene	2.1E-03	2.1E-03	2.6E-07	1.0E-02	2.1E+03	9.9E-09	3.0E-10	4.1E-08	2.0E+03	2.0E+04	2.0E+05
Trichloroethene	4.6E-02	4.6E-02	4.1E-06	1.0E-02	2.7E+03	2.2E-07	6.5E-09	5.0E-07	1.4E+02	1.4E+03	1.4E+04
SVOCs											
Benzo(a)anthracene	7.3E-01	7.3E-01	1.1E-04	1.3E-01		3.4E-06	1.3E-06	2.8E-11	2.1E+01	2.1E+02	2.1E+03
Benzo(a)pyrene	7.3E+00	7.3E+00	1.1E-03	1.3E-01		3.4E-05	1.3E-05	2.8E-10	2.1E+00	2.1E+01	2.1E+02
Benzo(b)fluoranthene	7.3E-01	7.3E-01	1.1E-04	1.3E-01		3.4E-06	1.3E-06	2.8E-11	2.1E+01	2.1E+02	2.1E+03
Benzo(k)fluoranthene	7.3E-02	7.3E-02	1.1E-04	1.3E-01		3.4E-07	1.3E-07	2.8E-11	2.1E+02	2.1E+03	2.1E+04
Dibenz(a,h)anthracene	7.3E+00	7.3E+00	1.2E-03	1.3E-01		3.4E-05	1.3E-05	3.0E-10	2.1E+00	2.1E+01	2.1E+02
Indeno(1,2,3-cd)pyrene	7.3E-01	7.3E-01	1.1E-04	1.3E-01		3.4E-06	1.3E-06	2.8E-11	2.1E+01	2.1E+02	2.1E+03
Dioxins/Furans											
2,3,7,8-TCDD (dioxin)	1.3E+05	1.3E+05	3.8E+01	3.0E-02		6.1E-01	5.5E-02	9.6E-06	1.5E-04	1.5E-03	1.5E-02
Inorganics											
Antimony	NA	NA	NA	1.0E-02							
Arsenic	1.5E+00	1.5E+00	4.3E-03	3.0E-02		7.1E-06	6.4E-07	1.1E-09	1.3E+01	1.3E+02	1.3E+03
Cadmium	NA	NA	1.8E-03	1.0E-03				4.5E-10	2.2E+05	2.2E+06	2.2E+07
Chromium (III)	NA	NA	NA	1.0E-02							
Copper	NA	NA	NA	1.0E-02							
Iron	NA	NA	NA	1.0E-02							
Manganese	NA	NA	NA	1.0E-02							
Mercury	NA	NA	NA	1.0E-02							
Thallium	NA	NA	NA	1.0E-02							
Vanadium	NA	NA	NA	1.0E-02							

Carcinogen calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{EF \times ED \times (Ac + Bc + Cc)}$$

Ac = CSFo x IRS/10^6 mg/kg x 1/BW

Bc = CSFd x SSA x AF x ABS x 1/10^6 mg/kg x 1/BW

Cc = IUR x 1000 ug/mg x (1/VF + 1/PEF) x ET x 1 day/24 hours

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	1
ET - Exposure Time (hours/day)	8
IRS - Ingestion rate (mg/day)	330
SA - Skin surface area (cm^2)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2-day)	0.3
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - No reference dose or slope factor available.

VF - calculated on Table A-5a, only included in calculation for VOCs.

Table A-19

Human Health Risk-Based Preliminary Remediation Goals

Construction Worker Scenario (Noncarcinogenic) for FDP

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Chronic Oral RfD (RfDo) (mg/kg-day)	Chronic Dermal RfD (RfDd) (mg/kg-day)	Subchronic Inhalation RfC (RfC) (mg/m^3)	Target Organ	Absorption Factor (ABS)	Volatilization Factor (VF) (m^3/kg)	An	Bn	Cn	Noncarcinogen PRG HQ = 0.1 (mg/kg)	HQ = 0.5 (mg/kg)	HQ = 1 (mg/kg)	PRG (mg/kg)	Target HQ[1] (mg/kg)
VOCs														
Trichloroethene	5.0E-04	5.0E-04	5.4E-01	Development, Adult Immunotoxicity, Fetal Cardiac, Neurological	1.0E-02	2.7E+03	6.6E-01	2.0E-02	6.8E-04	1.4E+01	7.0E+01	1.4E+02	**7.0E+01**	0.5
Dioxins/Furans														
2,3,7,8-TCDD (dioxin)	2.0E-08	2.0E-08	4.0E-08	Lymphatic	3.0E-02	NA	1.7E+04	1.5E+03	1.9E-02	5.7E-04	2.8E-03	5.7E-03	**5.7E-03**	1
Inorganics														
Arsenic	3.0E-04	3.0E-04	1.5E-05	Skin, Vascular	3.0E-02	NA	1.1E+00	9.9E-02	5.1E-05	8.5E+00	4.2E+01	8.5E+01	**8.5E+01**	1
Iron	7.0E-01	7.0E-01	NA	Gastrointestinal	1.0E-02	NA	4.7E-04	1.4E-05	NA	2.1E+04	1.1E+05	2.1E+05	**2.1E+05**	1
Manganese	2.4E-02	9.6E-04	5.0E-05	CNS	1.0E-02	NA	1.4E-02	1.0E-02	1.5E-05	4.1E+02	2.0E+03	4.1E+03	**2.0E+03**	0.5
Thallium	4.0E-05	4.0E-05	NA	Hair	1.0E-02	NA	8.3E+00	2.5E-01	NA	1.2E+00	6.0E+00	1.2E+01	**6.0E+00**	0.5
Vanadium	5.0E-03	5.0E-03	NA	Hair	1.0E-02	NA	6.6E-02	2.0E-03	NA	1.5E+02	7.5E+02	1.5E+03	**7.5E+02**	0.5

Noncarcinogenic calculations:

$$\textbf{Soil PRG (mg/kg)} = \frac{\text{Target HQ} \times AT_n}{EF \times ED \times (An/BW + Bn/BW + Cn)}$$

An = $1/RfDo \times IRS/10^6$ mg/kg

Bn = $1/RfDd \times SA \times AF \times ABS \times 1/10^6$ mg/kg

Cn = $1/RfC \times (1/PEF + 1/VF)$

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATnc - Averaging time for noncarcinogens (days)	365
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	1
IRS - Ingestion rate (mg/day)	330
SA - Skin surface area (cm^2)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2-day)	0.3
ABS - Absorption Factor (unitless)	chemical specific
IRA - Inhalation Rate (m^3/day)	20
ET -Exposure Time (hour/day)	8
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

VF - calculated on Table A-5a, only included in calculation for VOCs.

1 Target HQ calculated so that total HQ for a target organ does not exceed 1.

Table A-20

Human Health Risk-Based Preliminary Remediation Goals

Construction Worker Scenario (Carcinogenic) for FDP

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Oral Slope Factor (CSFo) (kg-day/mg)	Dermal Slope Factor (CSFd) (kg-day/mg)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Absorption Factor (ABS)	Volatilization Factor (VF) (m^3/kg)	Ac	Bc	Cc	Carcinogen Ingestion PRG Risk = 1E-06 (mg/kg)	Carcinogen Ingestion PRG Risk = 1E-05 (mg/kg)	Carcinogen Ingestion PRG Risk = 1E-04 (mg/kg)
VOCs											
Trichloroethene	4.6E-02	4.6E-02	4.1E-06	1.0E-02	2.7E+03	2.2E-07	6.5E-09	5.0E-07	1.4E+02	1.4E+03	1.4E+04
Dioxins/Furans											
2,3,7,8-TCDD (dioxin)	1.3E+05	1.3E+05	4.1E-06	3.0E-02	NA	6.1E-01	5.5E-02	1.0E-12	1.5E-04	1.5E-03	1.5E-02
Inorganics											
Arsenic	1.5E+00	1.5E+00	4.3E-03	3.0E-02	NA	7.1E-06	6.4E-07	1.1E-09	1.3E+01	1.3E+02	1.3E+03
Iron	NA	NA	NA	1.0E-02	NA						
Manganese	NA	NA	NA	1.0E-02	NA						
Thallium	NA	NA	NA	1.0E-02	NA						
Vanadium	NA	NA	NA	1.0E-02	NA						

Carcinogen calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{EF \times ED \times (Ac + Bc + Cc)}$$

Ac = CSFo x IRS/10^6 mg/kg x 1/BW

Bc = CSFd x SSA x AF x ABS x 1/10^6 mg/kg x 1/BW

Cc = IUR x 1000 ug/mg x (1/VF + 1/PEF) x ET x 1 day/24 hours

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	1
ET - Exposure Time (hours/day)	8
IRS - Ingestion rate (mg/day)	330
SA - Skin surface area (cm^2)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2-day)	0.3
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - No reference dose or slope factor available.

VF - calculated on Table D-5a

Table A-21

Human Health Risk-Based Preliminary Remediation Goals

Construction Worker Scenario (Noncarcinogenic) for ABG

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Chronic Oral RfD (RfDo) (mg/kg-day)	Chronic Dermal RfD (RfDd) (mg/kg-day)	Subchronic Inhalation RfC (RfC) (mg/m^3)	Target Organ	Absorption Factor (ABS)	An	Bn	Bn	Noncarcinogen PRG HQ = 0.1 (mg/kg)	HQ = 0.5 (mg/kg)	HQ = 1 (mg/kg)	PRG (mg/kg)	Target HQ[1] (mg/kg)
Explosives													
Perchlorate	7.0E-04	7.0E-04	NA	Thyroid	1.0E-02	4.7E-01	1.4E-02	NA	2.1E+01	1.1E+02	2.1E+02	**2.1E+02**	1
Inorganics													
Arsenic	3.0E-04	3.0E-04	1.5E-05	Skin, Vascular	3.0E-02	1.1E+00	9.9E-02	5.1E-05	8.5E+00	4.2E+01	8.5E+01	**8.5E+01**	1
Iron	7.0E-01	7.0E-01	NA	Gastrointestinal	1.0E-02	4.7E-04	1.4E-05	NA	2.1E+04	1.1E+05	2.1E+05	**2.1E+05**	1
Manganese	2.4E-02	9.6E-04	5.0E-05	CNS	1.0E-02	1.4E-02	1.0E-02	1.5E-05	4.1E+02	2.0E+03	4.1E+03	**4.1E+03**	1
Thallium	4.0E-05	4.0E-05	NA	Hair	1.0E-02	8.3E+00	2.5E-01	NA	1.2E+00	6.0E+00	1.2E+01	**6.0E+00**	0.5
Vanadium	5.0E-03	5.0E-03	NA	Hair	1.0E-02	6.6E-02	2.0E-03	NA	1.5E+02	7.5E+02	1.5E+03	**7.5E+02**	0.5

Noncarcinogenic calculations:

$$\textbf{Soil PRG (mg/kg)} = \frac{\text{Target HQ x } AT_n}{\text{EF x ED x (An/BW + Bn/BW + Cn)}}$$

An = $1/RfDo \times IRS/10^6$ mg/kg

Bn = $1/RfDd \times SA \times AF \times ABS \times 1/10^6$ mg/kg

Cn = 1/RfC x (1/PEF)

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATnc - Averaging time for noncarcinogens (days)	365
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	1
IRS - Ingestion rate (mg/day)	330
SA - Skin surface area (cm^2)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2-day)	0.3
ABS - Absorption Factor (unitless)	chemical specific
IRA - Inhalation Rate (m^3/day)	20
ET -Exposure Time (hour/day)	8
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

1 Target HQ calculated so that total HQ for a target organ does not exceed 1.

Table A-22

Human Health Risk-Based Preliminary Remediation Goals

Construction Worker Scenario (Carcinogenic) for ABG

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	Oral Slope Factor (CSFo) (kg-day/mg)	Dermal Slope Factor (CSFd) (kg-day/mg)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$	Absorption Factor (ABS)	Volatilization Factor (VF) (m^3/kg)	Ac	Bc	Cc	Carcinogen Ingestion PRG Risk = 1E-06 (mg/kg)		
									Risk = 1E-06 (mg/kg)	Risk = 1E-05 (mg/kg)	Risk = 1E-04 (mg/kg)
Explosives											
Perchlorate	NA	NA	NA	1.0E-02	NA						
Inorganics											
Arsenic	1.5E+00	1.5E+00	4.3E-03	3.0E-02	NA	7.1E-06	6.4E-07	1.1E-09	1.3E+01	1.3E+02	1.3E+03
Iron	NA	NA	NA	1.0E-02	NA						
Manganese	NA	NA	NA	1.0E-02	NA						
Thallium	NA	NA	NA	1.0E-02	NA						
Vanadium	NA	NA	NA	1.0E-02	NA						

Carcinogen calculations:

$$\textbf{Soil RBC (mg/kg)} = \frac{TR \times AT_c}{EF \times ED \times (Ac + Bc + Cc)}$$

Ac = CSFo x IRS/10^6 mg/kg x 1/BW

Bc = CSFd x SSA x AF x ABS x 1/10^6 mg/kg x 1/BW

Cc = IUR x 1000 ug/mg x (1/VF + 1/PEF) x ET x 1 day/24 hours

EXPOSURE ASSUMPTIONS	
BW - Body weight (kilograms)	70
ATc - Averaging time for carcinogens (days)	25,550
EF - Exposure frequency (days/year)	250
ED - Exposure duration (year)	1
ET - Exposure Time (hours/day)	8
IRS - Ingestion rate (mg/day)	330
SA - Skin surface area (cm^2)	3,300
AF - Soil to Skin Adherence Factor (mg/cm^2-day)	0.3
ABS - Absorption Factor (unitless)	chemical specific
PEF - Particulate Emission Factor (m^3/kg)	1.32E+09

NA - No reference dose or slope factor available.

Table A-23

Human Health Risk-Based Preliminary Remediation Goals

Construction Worker Scenario (Lead) for OABG

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES III (Phases 1&2)
$PbB_{fetal,\ 0.95}$	95th percentile PbB in fetus	ug/dL	10	10
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	2.1
PbB_0	Baseline PbB	ug/dL	1.0	1.5
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.100	0.100
$AF_{S,\ D}$	Absorption fraction (same for soil and dust)	--	0.12	0.12
$EF_{S,\ D}$	Exposure frequency (same for soil and dust)	days/yr	219	219
$AT_{S,\ D}$	Averaging time (same for soil and dust)	days/yr	365	365
PRG		**ppm**	**1,120**	**618**

Table A-24

Human Health Risk-Based Preliminary Remediation Goals

Industrial Worker Scenario (Lead) for OABG

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee
Version date 6/21/09

Variable	Description of Variable	Units	GSDi and PbBo from Analysis of NHANES 1999-2004	GSDi and PbBo from Analysis of NHANES III (Phases 1&2)
$PbB_{fetal, 0.95}$	95th percentile PbB in fetus	ug/dL	10	10
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4	0.4
GSD_i	Geometric standard deviation PbB	--	1.8	2.1
PbB_0	Baseline PbB	ug/dL	1.0	1.5
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050	0.050
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	219	219
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365	365
PRG		**ppm**	**2,240**	**1,235**

Table A-25

Recommended Human Health Risk-Based Preliminary Remediation Goals for Soil

Industrial Scenario

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, West Virginia

Chemical	OABG				FDP				ABG			
	Industrial Worker		Construction Worker		Industrial Worker		Construction Worker		Industrial Worker		Construction Worker	
	Recommended Soil PRG (mg/kg)	Basis	Recommended Soil PRG (mg/kg)	Basis	Recommended Soil PRG (mg/kg)	Basis	Recommended Soil PRG (mg/kg)	Basis	Recommended Soil PRG (mg/kg)	Basis	Recommended Soil PRG (mg/kg)	Basis
VOCs												
Tetrachloroethene	6.1E+01	HQ = 0.5	1.2E+02	HQ = 1								
Trichloroethene	3.9E+00	HQ = 0.5	7.0E+01	HQ = 0.5	3.9E+00	HQ = 0.5	7.0E+01	HQ = 0.5				
SVOCs												
Benzo(a)anthracene	2.1E+01	CR = 10^{-5}	2.1E+02	CR = 10^{-5}								
Benzo(a)pyrene	2.1E+00	CR = 10^{-5}	2.1E+01	CR = 10^{-5}								
Benzo(b)fluoranthene	2.1E+01	CR = 10^{-5}	2.1E+02	CR = 10^{-5}								
Benzo(k)fluoranthene	2.1E+02	CR = 10^{-5}	2.1E+03	CR = 10^{-5}								
Dibenz(a,h)anthracene	2.1E+00	CR = 10^{-5}	2.1E+01	CR = 10^{-5}								
Indeno(1,2,3-cd)pyrene	2.1E+01	CR = 10^{-5}	2.1E+02	CR = 10^{-5}								
Dioxins/Furans												
2,3,7,8-TCDD (dioxin)	1.8E-04	CR = 10^{-5}	1.5E-03	CR = 10^{-5}	1.8E-04	CR = 10^{-5}	1.5E-03	CR = 10^{-5}				
Explosives												
Perchlorate									6.7E+02	HQ=1	2.1E+02	HQ = 1
Inorganics												
Antimony	2.8E+02	HQ = 1	1.0E+02	HQ = 1								
Arsenic	1.6E+01	CR = 10^{-5}	8.5E+01	HQ = 1	1.6E+01	CR = 10^{-5}	8.5E+01	HQ = 1	1.6E+01	CR = 10^{-5}	8.5E+01	HQ = 1
Cadmium	7.9E+02	HQ = 1	1.4E+02	HQ = 1								
Chromium (III)	2.5E+05	HQ = 1	1.4E+05	HQ = 1								
Copper	1.9E+04	HQ = 0.5	6.0E+03	HQ = 0.5								
Iron	3.4E+05	HQ = 0.5	1.1E+05	HQ = 0.5	6.7E+05	HQ = 1	2.1E+05	HQ = 1	6.7E+05	HQ = 1	2.1E+05	HQ = 1
Manganese	4.2E+03	HQ = 0.5	2.0E+03	HQ = 0.5	8.4E+03	HQ = 1	2.0E+03	HQ = 0.5	8.4E+03	HQ = 1	4.1E+03	HQ = 1
Mercury	7.9E+01	HQ = 0.5	6.5E+01	HQ = 1								
Thallium	4.8E+00	HQ = 0.5	6.0E+00	HQ = 0.5	4.8E+00	HQ = 0.5	6.0E+00	HQ = 0.5	4.8E+00	HQ = 0.5	6.0E+00	HQ = 0.5
Vanadium	2.4E+03	HQ = 0.5	7.5E+02	HQ = 0.5	2.4E+03	HQ = 0.5	7.5E+02	HQ = 0.5	2.4E+03	HQ = 0.5	7.5E+02	HQ = 0.5

Notes:

1. For constituents with basis of CR = 10^5, PRG for CR =10^{-5} less than PRG for applicable HQ.
2. Used CR of 10^{-5} to keep overall carcinogenic risk below 10^4.
3. Applicable HQ chosen to keep total HI for each target organ equal to or less than 1.

Attachment B
Supporting Calculations for Ecological Risk Based PRGs

TABLE B.1
Summary of Ecological Risk-Based PRGs
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Chemical	Ecological Chemical of Concern				Soil PRG		
	OABG (Floodplain)		ABG/FDP (Upland)				
	Surface Soil	Food Web	Surface Soil	Food Web	Value	Units	Basis
Metals							
Cadmium	X	X			17.4	mg/kg	Back-calculated food web (shrew LOAEL)[1]
Chromium	X				42.7	mg/kg	Soil invertebrate toxicity test NOEC (survival)[2]
Copper	X		X		253	mg/kg	Soil invertebrate toxicity test NOEC (survival)[2]
Lead	X	X	X		785	mg/kg	Back-calculated food web (robin LOAEL)[1]
Mercury	X	X	X		1.61	mg/kg	Back-calculated food web (shrew LOAEL)[1]
Nickel	X				78.4	mg/kg	Maximum reference concentration[3]
Silver	X				42.6	mg/kg	Soil invertebrate toxicity test NOEC (reproduction)[2]
Vanadium	X				173	mg/kg	Soil invertebrate toxicity test NOEC (reproduction)[2]
Zinc	X	X			1,170	mg/kg	Soil invertebrate toxicity test NOEC (survival)[2]
Semivolatile Organic Compounds							
2-Nitroaniline			X		--	--	Insufficient data to develop a PRG
PAHs, Low Molecular Weight[4]	X				29,000	ug/kg	Eco-SSL (USEPA 2007) - soil invertebrates
PAHs, High Molecular Weight[5]	X				18,000	ug/kg	Eco-SSL (USEPA 2007) - soil invertebrates
Explosives							
1,3,5-Trinitrobenzene			X		--	--	Insufficient data to develop a PRG
HMX	X		X		10,000	ug/kg	Soil screening value (Talmage et al. 1999)[6]
Nitroglycerin	X		X		65,000	ug/kg	Soil screening value (NRCC 2006)
Perchlorate			X		1,000	ug/kg	Soil screening value (USEPA 2002) - soil invertebrates
RDX	X		X		10,000	ug/kg	Soil screening value (Talmage et al. 1999)[6]
Volatile Organic Compounds							
1,2-Dichloroethene	X				450	ug/kg	Soil screening value (MHSPE 2000)[7]
Methyl acetate	X				300	ug/kg	Soil invertebrate toxicity test NOEC (survival)[2]
Trichloroethene	X				2,500	ug/kg	Soil screening value (MHSPE 2000)[7]
Dioxin/furans							
Total dioxin/furans (TEQ)[8]		X			9.60E-05	mg/kg	Back-calculated food web (weasel LOAEL)[1]

[1] See Table B.2
[2] See Table B.3
[3] Due to small sample sizes (n=4), the maximum reference concentration was used in place of the 95% UCL
[4] PAH compounds with 3 or fewer rings
[5] PAH compounds with 4 or more rings
[6] LOEC with uncertainty factor of 5
[7] Geometric mean of the target and intervention values
[8] Based upon 2,3,7,8-TCDD equivalents, mammalian TEFs, and the 17 individual dioxin/furan congeners

TABLE B.2-1
Derivation of Ecological Risk-Based PRGs For Cadmium Based Upon Food Web Models for the Short-tailed Shrew
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	LOAEL TRV (mg/kg/d)	LOAEL HQ
Cadmium	17.4	7.66	133	0.514	8.94	2.212	38.5	0.00027	9.97	10.0	1.0

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specifi	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0015	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specifi	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.823	= Proportion of diet composed of food item (soil invertebrates, dry weight basis)
FCxi =	Chemical-specifi	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.047	= Proportion of diet composed of food item (terrestrial plants, dry weight basis)
FCxi =	Chemical-specifi	= Concentration of chemical in food item (small mammals, dry weight basis)
PDFi =	0.00	= Proportion of diet composed of food item (small mammals, dry weight basis)
SCx =	Chemical-specifi	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.13	= Proportion of diet composed of soil (dry weight basis)
WIR =	0.0038	= Water ingestion rate (L/day)
WC =	Chemical-specifi	= Concentration of chemical in water (mg/L)
BW =	0.0169	= Body weight (kg)

TABLE B.2-2

Derivation of Ecological Risk-Based PRGs for Lead Based Upon Food Web Models for the American Robin

Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1

Allegany Ballistics Laboratory, Rocket Center, WV

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	LOAEL TRV (mg/kg/d)	LOAEL HQ
Lead	785	0.31	243	0.038	29.8	0.148	116	0.0014	11.3	11.3	1.0

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specifi	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0055	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specifi	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.436	= Proportion of diet composed of food item (soil invertebrates, dry weight basis)
FCxi =	Chemical-specifi	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.516	= Proportion of diet composed of food item (terrestrial plants, dry weight basis)
FCxi =	Chemical-specifi	= Concentration of chemical in food item (small mammals, dry weight basis)
PDFi =	0.00	= Proportion of diet composed of food item (small mammals, dry weight basis)
SCx =	Chemical-specifi	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.048	= Proportion of diet composed of soil (dry weight basis)
WIR =	0.0106	= Water ingestion rate (L/day)
WC =	Chemical-specifi	= Concentration of chemical in water (mg/L)
BW =	0.0773	= Body weight (kg)

TABLE B.2-3
Derivation of Ecological Risk-Based PRGs For Mercury Based Upon Food Web Models for the Short-tailed Shrew
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	LOAEL TRV (mg/kg/d)	LOAEL HQ
Mercury	1.61	1.19	1.92	0.344	0.55	0.067	0.11	0.000086	0.16	0.16	1.0

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI = Chemical-specifi = Dietary intake for chemical (mg chemical/kg body weight/day)
FIR = 0.0015 = Food ingestion rate (kg/day dry weight)
FCxi = Chemical-specifi = Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi = 0.823 = Proportion of diet composed of food item (soil invertebrates, dry weight basis)
FCxi = Chemical-specifi = Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi = 0.047 = Proportion of diet composed of food item (terrestrial plants, dry weight basis)
FCxi = Chemical-specifi = Concentration of chemical in food item (small mammals, dry weight basis)
PDFi = 0.00 = Proportion of diet composed of food item (small mammals, dry weight basis)
SCx = Chemical-specifi = Concentration of chemical in soil (mg/kg, dry weight)
PDS = 0.13 = Proportion of diet composed of soil (dry weight basis)
WIR = 0.0038 = Water ingestion rate (L/day)
WC = Chemical-specifi = Concentration of chemical in water (mg/L)
BW = 0.0169 = Body weight (kg)

TABLE B.2-4
Derivation of Ecological Risk-Based PRGs for Dioxins Based Upon Food Web Models for the Long-tailed Weasel
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Chemical	Surface Soil Concentration (mg/kg)	Soil-Worm BAF	Terrestrial Invertebrate Concentration (mg/kg dw)	Soil-Plant BAF	Terrestrial Plant Concentration (mg/kg dw)	Soil-Mammal BAF	Small Mammal Concentration (mg/kg dw)	Surface Water Concentration (mg/L)	Dietary Intake (mg/kg/day)	LOAEL TRV (mg/kg/d)	LOAEL HQ
Dioxin (TEQ)	9.60E-05	0.88	0.000084	0.0065	0.00000062	1.07	0.00010	0.00	0.000010	0.00001	1.0

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]]}{BW}$$

DI =	Chemical-specifi	= Dietary intake for chemical (mg chemical/kg body weight/day)
FIR =	0.0142	= Food ingestion rate (kg/day dry weight)
FCxi =	Chemical-specifi	= Concentration of chemical in food item (soil invertebrates, dry weight basis)
PDFi =	0.00	= Proportion of diet composed of food item (soil invertebrates, dry weight basis)
FCxi =	Chemical-specifi	= Concentration of chemical in food item (terrestrial plants, dry weight basis)
PDFi =	0.00	= Proportion of diet composed of food item (terrestrial plants, dry weight basis)
FCxi =	Chemical-specifi	= Concentration of chemical in food item (small mammals, dry weight basis)
PDFi =	0.972	= Proportion of diet composed of food item (small mammals, dry weight basis)
SCx =	Chemical-specifi	= Concentration of chemical in soil (mg/kg, dry weight)
PDS =	0.028	= Proportion of diet composed of soil (dry weight basis)
WIR =	0.0176	= Water ingestion rate (L/day)
WC =	Chemical-specifi	= Concentration of chemical in water (mg/L)
BW =	0.1470	= Body weight (kg)

TABLE B.3-1
Derivation of Ecological Risk-Based PRGs Based Upon Soil Invertebrate Toxicity Tests - Survival Endpoint
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Sample	Mean Survival (%)	Significant Difference			Impacted?	Methyl acetate UG/KG	Chromium MG/KG	Copper MG/KG	Zinc MG/KG
		Control	Ref 1	Ref 2					
Lab Control	97.5	NA			--				
Reference 1/AS01-SS45-(0-1)	47.5		NA		No	3.30	12.1	24.1	163
AS01-SS50-(0-1)	87.5				No	11.0	10.4	17.4	63.2
AS01-SS52-(0-1)	70.0				No	300	42.7	253	1,170
AS01-SS58-(0-1)	92.5				No	ND or NA	14.0	39.8	180
					Maximum = NOEC:	300	42.7	253	1,170
AS01-SS46-(0-1)	10.0	√			Yes	2.90	14.2	37.8	191
AS01-SS47-(0-1)	7.50	√			Yes	ND or NA	15.7	46.6	217
AS01-SS48-(0-1)	12.5	√			Yes	850	14.1	43.1	161
AS01-SS49-(0-1)	45.0	√			Yes	450	19.7	43.5	181
AS01-SS51-(0-1)	5.00	√			Yes	320	23.5	123	845
AS01-SS53-(0-1)	17.5	√			Yes	ND or NA	63.8	284	1,400
AS01-SS54-(0-1)	7.50	√			Yes	ND or NA	17.1	44.1	176
Reference 2/AS01-SS55-(0-1)	12.5	√		NA	Yes	ND or NA	11.5	26.7	181
AS01-SS56-(0-1)	70.0	√			Yes	ND or NA	15.6	41.0	200
AS01-SS57-(0-1)	72.5	√			Yes	ND or NA	59.5	517	841
AS01-SS59-(0-1)	75.0	√			Yes	ND or NA	16.4	44.1	181

√ indicates a statistically significant decrease in response

TABLE B.3-2
Derivation of Ecological Risk-Based PRGs Based Upon Soil Invertebrate Toxicity Tests - Reproduction Endpoint
Site Remediation Goal Selection Process and Evaluation of Target Remediation Areas in Soil at Site 1
Allegany Ballistics Laboratory, Rocket Center, WV

Sample	No. of Juveniles	No. of Cocoons	Sign of Reproduction	Impacted?	Silver MG/KG	Vanadium MG/KG
Lab Control	0.25	11.5	Yes	--		
Reference 1/AS01-SS45-(0-1)	0	4.00	Yes	No	ND	15.5
AS01-SS47-(0-1)	0.50	0.25	Yes	No	2.90	21.3
AS01-SS49-(0-1)	0	2.50	Yes	No	ND	21.8
AS01-SS50-(0-1)	0.25	0.50	Yes	No	ND	16.1
AS01-SS52-(0-1)	0	0.50	Yes	No	2.40	22.4
AS01-SS53-(0-1)	0	3.75	Yes	No	42.6	173
AS01-SS54-(0-1)	0.50	1.50	Yes	No	ND	25.4
AS01-SS56-(0-1)	0.25	1.50	Yes	No	ND	21.9
AS01-SS57-(0-1)	0.50	0.50	Yes	No	5.50	58.3
AS01-SS58-(0-1)	0	3.75	Yes	No	ND	22.1
AS01-SS59-(0-1)	0	0.25	Yes	No	ND	24.9
			Maximum = NOEC:		42.6	173
AS01-SS46-(0-1)	0	0	No	Yes	ND	18.3
AS01-SS48-(0-1)	0	0	No	Yes	3.30	21.8
AS01-SS51-(0-1)	0	0	No	Yes	ND	26.5
Reference 2/AS01-SS55-(0-1)	0	0	No	Yes	ND	16.0

√ indicates a statistically significant decrease in response

Attachment C
Comments and Navy Responses

Comments and Navy Responses to the

Draft Technical Memorandum Site Remediation Goal Selection Process and Evaluation of Areas of Contaminated Soil for Remediation at Site 1 Allegany Ballistics Laboratory, Rocket Center, West Virginia

USEPA'S COMMENTS DATED August 17, 2012 on the *Site Remediation Goal Selection Process and Evaluation of Areas of Contaminated Soil for Remediation at Site 1 Technical Memorandum, Allegany Ballistics Laboratory, Rocket Center, West Virginia, March 2012*

Comments submitted by Sarah Kloss, EPA RPM

General Comments

1. EPA concurs with the site specific remediation goals that are contained in this memorandum as long as they are up to date in accordance with comment 3 below. Based on our own analysis of the data, we also concur with the areas that should be targeted for remediation. However, there are concerns related to the field application of the remedial goals. These concerns do not affect the "areas of contaminated soil for remediation" or the "remedial goals." Thus, while the EPA concurs with the memo in the scope of defining remediation areas and remedial goals, it is important to note that concurrence with this memo does not include concurrence with any language that implies agreements as to how the remedial goals will be used in the field if an excavation remedial action is selected. For example the introductory paragraph notes that "this memorandum presents the method for determining how the SRGs will be applied through a comparison of the 95% upper confidence limit (UCL) of site-wide soil concentrations within the active burning grounds (ABG) and outside active burning grounds (OABG)." This language suggests that there is an agreement related to field application of the 95% UCL, which there is not. Concerns with the use of the 95% UCL include: removing sample concentrations from the dataset without replacing them with the concentrations left in place and the use of the calculated UCL in relation to a do-not-exceed value. Again, regardless of our issues with the methodology used in the UCL calculations, our own analysis highlights basically the same areas requiring remediation; thus, there is enough information to proceed with the FS. For further details about the issues with the way the UCL is being used, we suggest a meeting with EPA technical support.

   Navy Response: The SRGs have been updated to incorporate changes in toxicity criteria, drinking water standards and/or risk methodology as presented in the spring 2012 RSL table. See general comment #3 for details.

   It was not the Navy's intention for the technical memorandum to address how the post remedial action confirmation sampling would be interpreted or how the remedial goals will be used in the field if an excavation remedial action is selected. The Introduction section has been revised to state,

   > **"This technical memorandum presents the proposed site remediation goals (SRGs) and method for applying a 95% upper confidence limit (UCL) of site-wide soil concentrations within the active burning grounds (ABG) and outside active burning grounds (OABG) to determine areas of concern (AOCs) that will be targeted for remediation in Operable Unit 4 (OU-4), Site 1 soil, at Allegany Ballistics Laboratory (ABL) located in Rocket Center, West Virginia. The human health and ecological preliminary remediation goals (PRGs) and site-specific soil-**

to-groundwater leaching considerations discussed herein supersede previous partnering team discussions and decisions regarding Site 1 SRGs.

The Navy, in partnership with West Virginia Department of Environmental Protection (WVDEP) and the US Environmental Protection Agency (EPA), will utilize the AOCs presented in this memo to define the general areas of concern in soil for use as part of the remedial alternative development and comparison in the Feasibility Study (FS). This technical memorandum does not address how the post remedial action confirmation sampling will be interpreted or how the remedial goals will be used in the field if an excavation alternative is selected as the final remedy. Furthermore, additional data collection efforts may be necessary to refine remedial target areas presented in this memo prior to selection of the final remedy which will be presented in the Record of Decision (ROD) in accordance with the Navy's Environmental Restoration Program, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance (EPA, 1999), the National Oil and Hazardous Substance Pollution Contingency Plan (Title 40 Code of Federal Regulations Part 300 et seq.), and other relevant EPA guidance."

Concerns regarding the methods used to conduct the 95% UCL were discussed on the August 15, 2012 conference call with technical support staff from EPA, NAVFAC, and CH2MHILL. The team agreed that although there are multiple ways to run the 95% UCL to determine the focused remediation areas, the outcome remains the same as stated in EPA's general comment #1. Therefore changes to the use of the 95% UCL are not recommended at this time.

2. Ecological Risk: Tables 9 through 14 present the results of the iterative removal of contaminated soil locations under various human exposure scenarios. The memo indicates that each of these scenarios included evaluation using ecological remedial goals. This information may be included in the color-coding of the tables, yet no legend is provided to demonstrate which areas require removal for protection of ecological protection. The BTAG requests that a legend be provided to reviewers to enable tracking of the remedial goal driving the selection of soil areas for removal to meet the 95% UCL objective. Figures indicating areas requiring remediation by exposure scenario (e.g., human industrial, ecological) would also clarify factors defining areas of remediation.

   Navy Response: Although the removal scenarios evaluated are labeled "industrial" or "residential", they are not human exposure scenarios per se. The SRGs used to define the potential removal areas are the lower of the human health PRGs, the ecological PRGs, and the groundwater SSLs, plus a consideration of facility-specific or site-specific background data and site-specific groundwater concentration data, as summarized in Tables 7 and 8. The "industrial" versus "residential" designation simply refers to which of the human health-based PRGs (residential or industrial) was used in the SRG derivation for that scenario. As shown on Table 7, for the ABG, the selected SRG for five of the 11 final COCs (3 explosives and 2 metals) was based upon the ecological PRG (the other 6 were based upon one of the other PRGs since they were lower than the ecological PRG for those constituents). As shown on Table 8, for the OABG, the selected SRG for 14 of the 26 final COCs (for the industrial scenario) was based upon the ecological PRG. The color coding in Tables 9 through 14

does not relate to the PRG used to define the SRG; a legend describing the color coding has been added to Tables 9 through 14.

The potential removal areas identified were derived considering all three exposure/risk categories (human health, ecological, and leaching to groundwater), and background, simultaneously, as is appropriate for an evaluation to support the FS. Because the SRGs are not used as not-to-exceed values in the UCL scenarios, it would be very difficult to identify removal areas based on each of the individual PRGs since the removal of samples in the first steps of the analysis (which may be driven by a COC whose SRG is based upon a non-ecological PRG) impacts what samples are removed in later steps (and thus the ultimate removal area) Therefore, no modifications or additional figures are recommended.

3. The PRGs and SSLs should be updated based on changes in toxicity criteria, drinking water standards and/or risk methodology as presented in the current spring 2012 RSL table.

   Navy Response: The PRGs and SSLs have been updated based on the changes in toxicity criteria, drinking water standards and/or risk methodology as presented in the current spring 2012 RSL table. In addition, the arsenic background concentration previously reported was incorrect. The arsenic background was revised and reevaluated during the revision process. The ABG COCs that have been affected:

   - **Human health PRG – 2,3,7,8-TCDD for residential scenario**
   - **SSL – 2-nitroaniline, 1,3,5-trinitrobenzene, HMX, nitroglycerin, cobalt, iron, manganese, and vanadium**
   - **SRG – arsenic for residential scenario, and manganese for residential and industrial scenario**

   The OABG COCs that have been affected:

   - **Human health PRG – PCE for residential and industrial scenarios, 2,3,7,8-TCDD for residential scenario, and manganese for residential and industrial scenarios**
   - **SSL - Bromodichloromethane, methyl acetate, HMX, nitroglycerin, cobalt, iron, manganese, nickel, silver, vanadium, and zinc**
   - **SRG – arsenic for residential scenario, bromodichloromethane for residential and industrial scenarios, nitroglycerin for residential and industrial scenario, subsurface cobalt for residential and industrial scenarios, and iron for industrial scenario. In addition, there was a typo for the industrial SRG for benzo(b)fluoranthene, which has been corrected.**

Tables 3 and 5 through 14 have been revised to reflect the changes.

Specific Comments

1. The Site Specific Soil Screening Levels discussion should explain (in the narrative) the input parameters that were used to calculate the dilution attenuation factor (DAF) and what this input to the SSL equation represents.

   Navy Response: The DAF equation " $DAF = 1 + \frac{Kid}{IL}$ **" has been added to the Procedure for Calculating SSLs section to explain the input parameters that were used to calculate the DAF. All input parameters for the DAF are already included in Table 3. The fourth, fifth, and sixth sentence in the section have been revised to state, "Typically, lateral groundwater flux within the underlying aquifer is much greater than the vertical recharge and a dilution attenuation factor (DAF) has been used in calculating the SSL. The groundwater protection standard (**C_w**) is the product of the potable groundwater standard (MCL or RSL) and the DAF. The** C_w **term in the diluted standard. The input parameters to the SSL equilibrium equation and DAF equation are listed in Table 3."**

2. The Perchlorate SSL discussion includes a final paragraph that mentions DAFs. Table 4 also includes DAFs for perchlorate calculation. It's unclear how the DAF was used in the given formula. Further, it's unclear how the exposure duration input parameter was calculated.

   Navy Response: The DAF is used in the perchlorate approach (mass limited SSL) in the same manner as used for the other parameters (infinite mass) as discussed in specific comment 1. The exposure duration parameter is not calculated, but provided by EPA in the guidance documents as 70 years.

WVDEP'S COMMENTS DATED August 9, 2012 on the *Site Remediation Goal Selection Process and Evaluation of Areas of Contaminated Soil for Remediation at Site 1 Technical Memorandum, Allegany Ballistics Laboratory, Rocket Center, West Virginia, March 2012*

Comments submitted by Thomas Bass, WVDEP RPM

General Comments:

1. The approach outlined in the document identified above, attempts to provide a statistical approach to delineate the aerial extent of contamination for future remediation. This process is based on the ranges of contaminant concentrations reported for samples obtained throughout the 2 identified areas (ABG and OABG) and focuses on the highest values. While the approach appears to identify likely source areas, there is considerable uncertainty regarding the lateral and vertical extents of contamination. Unfortunately this uncertainty is exacerbated by defining areas of contamination on the basis of contaminant levels without consideration of the spatial relationships between samples identified as "contaminated".

   Navy Response: It is agreed that there is some uncertainty in the lateral and vertical extents of the areas of concern to be targeted for remediation. In an effort to eliminate the uncertainties, a pre-design study will be conducted to refine the areas of concern and bound the lateral and vertical limits of excavation. During the August 2012 partnering meeting, given the site understanding and low potential for the areas of concern to significantly increase/decrease, the Team agreed that the pre-design study is not necessary to select a remedy, and prepare the proposed remedial action plan and record of decision. However, the results will be used to support future Team decisions and refine the design once the final remedy is selected.

   The Introduction section has been revised to state,

   > **"This technical memorandum presents the proposed site remediation goals (SRGs) and method for applying a 95% upper confidence limit (UCL) of site-wide soil concentrations within the active burning grounds (ABG) and outside active burning grounds (OABG) to determine areas of concern (AOCs) that will be targeted for remediation in Operable Unit 4 (OU-4), Site 1 soil, at Allegany Ballistics Laboratory (ABL) located in Rocket Center, West Virginia. The human health and ecological preliminary remediation goals (PRGs) and site-specific soil-to-groundwater leaching considerations discussed herein supersede previous partnering team discussions and decisions regarding Site 1 SRGs.**
   >
   > **The Navy, in partnership with WVDEP and the EPA, will utilize the AOCs presented in this memo to define the general areas of concern in soil for use as part of the remedial alternative development and comparison in the Feasibility Study (FS). This technical memorandum does not address how the post remedial action confirmation sampling will be interpreted or how the remedial goals will be used in the field if an excavation alternative is selected as the final remedy. Furthermore, additional data collection efforts may be necessary to refine remedial target areas presented in this memo prior to selection of the final remedy which will be presented in the Record of Decision (ROD) in accordance with the**

Navy's Environmental Restoration Program, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance (EPA, 1999), the National Oil and Hazardous Substance Pollution Contingency Plan (Title 40 Code of Federal Regulations Part 300 et seq.), and other relevant EPA guidance."

2. A primary objective of the future remedial action should conform to the requirements of §47 CSR 12.3.2.b.

   Where the concentration of a certain constituent exceeds an otherwise applicable groundwater quality standard due to human-induced contamination, no further contamination by that constituent shall be allowed and every reasonable effort shall be made to identify, remove or mitigate the source of such contamination and to strive, where practical, to reduce the level of contamination over time to support drinking water use.

   Given this requirement, as well as the issue identified above, WVDEP cannot support deviating from the calculated remedial target concentrations as currently approved.

   Navy Response: Compliance with the referenced statute is established by the inclusion of 47 CSR 57-4.1 as an ARAR in the forthcoming revised draft FS.

USEPA'S COMMENTS RECEIVED VIA EMAIL on January 4, 2013 on the *Site Remediation Goal Selection Process and Evaluation of Areas of Contaminated Soil for Remediation at Site 1 Technical Memorandum, Allegany Ballistics Laboratory, Rocket Center, West Virginia, October 2012*

<u>Comments submitted by Sarah Kloss, EPA RPM and Navy Responses</u>

1. PCE – The Report states that the RfC was not considered in the remedial goal for PCE because the inhalation pathway was not previously a risk driver. However, consideration of changes in toxicity criteria for the inhalation route will result in the non-cancer remedial goals (as calculated using the calculator in the RSL Table and site-specific exposure parameters at an HI=1) of 86 mg/kg for the resident; 410 mg/kg for the industrial worker; and, 357 mg/kg for the construction worker, to drive the risk for PCE when the cancer remedial goals are set at 1E-05. Please consider revising the remedial goals for PCE to include the inhalation route based on current toxicity criteria and appropriate consideration of target risk and target organs.

   Response: *The remedial goals for PCE based on non-cancer have been updated to include the inhalation route. Table 8 and Attachment A have been revised accordingly.*

2. TCE – The Report states that the RfC was not considered in the remedial goal for TCE because the inhalation pathway was not previously a risk driver. However, consideration of changes in toxicity criteria for the inhalation route will result in the non-cancer remedial goals (as calculated using the calculator in the RSL Table and site-specific exposure parameters at an HI=1) of 4.4 mg/kg for the residential scenario; 20 mg/kg for the industrial scenario; and, 18 mg/kg for the construction worker, to drive the risk for TCE when the cancer remedial goals are set at 1E-05. Please consider revising the remedial goals for TCE to include the inhalation route based on current toxicity criteria and appropriate consideration of target risk and target organs.

   Response: *The remedial goals for TCE based on non-cancer have been updated to include the inhalation route. Tables 7, 8, and Attachment A have been revised accordingly.*

3. Dioxin Remedial Goals: For the construction worker, the non-cancer remedial goal of 1.99E-04 mg/kg at an HI=1 (as calculated using the online RSL calculator and site-specific exposure parameters) is more protective than the cancer remedial goal of 1.5E-03mg/kg at a cancer risk of 1E-05. Note that it appears that an incorrect oral RfD was used in the calculations on Table A-19. The unit risk on Table A-20 should also be corrected. The oral RfD for Dioxin is 7E-10 mg/kg/day, not 2E-08 mg/kg/day. The inhalation unit risk for dioxin is 3.8E+01 (ug/m3)-1, not 4.1E-06 (ug/m3)-1. Please consider revising the remedial goals for Dioxin for the construction worker using current toxicity criteria and appropriate consideration of target risks and target organs.

   Response: *The subchronic oral RfD of 2E-08 mg/kg-day for dioxin from the ATSDR Toxicity Profile for Chloridated Dibenzo-p-Dioxins (December 1998) was used for the construction worker scenario, as the construction worker was assumed to be exposed to site soil for less than 7 years (for 1 year). Therefore, no change is recommended.*

4. Manganese- The revised remedial goals do not reflect current toxicity criteria for the *non-dietary* pathway including the RfC for all exposure scenarios. The remedial goals at an HI=1 calculated using the online RSL calculator are 1,800 mg/kg (900 mg/kg at HI=0.5) for the resident; 2.3E+04 mg/kg (11,500 mg/kg at HI=0.5) for the industrial worker; and, 7,250 mg/kg (HI=1) for the construction worker. Please consider revising the remedial goals for manganese for all exposure scenarios using current toxicity criteria and appropriate consideration of target organs.

   Response: *The remedial goals for manganese have been updated using the RfD for the non-dietary pathway. Additionally, the inhalation pathway has been included in the remedial goals calculation for non-cancer using the RfD for manganese (pathway added based on Comments 1 and 2). Tables 7, 8, and Attachment A have been revised accordingly.*

5. Thallium – The revised remedial goal for thallium does not reflect changes in the RfD for the construction worker. The remedial goal at an HI=1 using the online RSL calculator and revised RfD of 1E-05 mg/kg/day is 3.1 mg/kg, not 12 mg/kg. Please consider revising the remedial goal for thallium for the construction worker using current toxicity criteria and appropriate consideration of target organs.

   Response: *The subchronic oral RfD of 4E-05 mg/kg-day for dioxin thallium from the Risk Assessment Information System database was used for the construction worker scenario, as the construction worker was assumed to be exposed to site soil for less than 7 years (for 1 year). Therefore, no change recommended.*

6. Note that table 8 indicates that the DAF used is 236, not 232 (see table 3.) Please use a consistent DAF.

   Response: Table 3 has been revised to reflect a DAF of 236.

7. Page 7, Number 2. The Report defines surface soil as between 0-5 feet below ground. It should be noted that this is the surface soil depth for ecological risk. For human health risk, surface soil is considered between 0-2 ft below ground surface.

   Response: *Page 7, Number 2 was revised eliminate the discussion on soil depth. The next numbered bullet in the text indicates the assumption for 0-5 ft is based on ecological receptor exposures as agreed by the Team.*

   The location and depth of each soil sample was identified. Sample locations are shown on Figures 2 and 3. The evaluation was conducted separately for the ABG and OABG and each evaluation used a combined surface soil and subsurface soil data set. The following text has been deleted from Number 2, "Based on previous agreements during the PRG development process, surface soil was defined as 0 to 5 feet below ground surface (bgs) and subsurface soil was defined as greater than 5 feet bgs."

Appendix B
ARARs

ARARs

B.1 Potential ARARs

Section 300.430 of the National Contingency Plan (NCP) requires that remedial actions implemented under CERCLA comply with the requirements of federal and state environmental laws, regulations, standards, criteria, and limits that are legally determined to be ARARs. To be applicable, a state or federal requirement must directly and fully address the circumstances at a site and satisfy all of the jurisdictional prerequisites for legal applicability. A requirement that is not applicable may be relevant and appropriate if it addresses situations sufficiently similar to be of use in evaluating the site.

Only substantive requirements can be ARARs; administrative requirements such as permits, reporting, recordkeeping, or consultation with administrative bodies are not ARARs. Non-promulgated advisories or guidance issued by federal or state governments are not legally binding and are not ARARs. However, such advisories or guidance may be useful and are “to be considered” (TBC) during the identification of ARARs. TBCs are intended to complement the use of ARARs and may be used to establish remedial action objectives in circumstances for which ARARs do not exist.

Pursuant to EPAs guidance, ARARs are generally divided into three categories:

- ***Chemical-specific ARARs*** establish numerical standards limiting the concentrations of substances in the medium of concern and/or the medium affected by the removal action.
- ***Location-specific ARARs*** are restrictions or considerations placed on the conduct of activities in specific locations.
- ***Action-specific ARARs*** are technology-based or activity-based restrictions controlling the removal action, and include performance and design standards.

Using the available investigation data, and considering the likely remedial technologies for the chemicals of concern (COCs), it is possible to produce a preliminary list of project-specific ARARs. Tables B-1 through B-3 summarize the chemical-specific, location-specific, and action-specific ARARs that have been identified for the FS.

TABLE B-1
Chemical-Specific Applicable or Relevant and Appropriate Requirements
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Media	Citation	Requirement	Prerequisites	Determination	Comments
No Federal Chemical-Specific ARARs Apply					
West Virginia Chemical Specific ARARs					
Soil	47 CSR 57	Owners of sources must cease further release of contaminants which exceed any applicable groundwater quality standard subject to the W. Va. Groundwater Protection and must make every reasonable effort to identify, remove or mitigate the source of such contamination and strive where practical to reduce the level of contamination over time to support drinking water use of such groundwater.	Source which has caused the concentration of any constituent to exceed any applicable quality standard subject to the Act	Applicable	Site 1 soils are considered a source of contamination to groundwater. Sources which are operating in full compliance with CERCLA remedial action requirements to address groundwater contamination shall be deemed to be in compliance this requirement. (All Alternatives)
Soil	33 CSR 20-10.1 only as it incorporates 40 CFR 268. 45, 48, and 49(c), (d), (e)	The generator must determine what treatment standards are applicable for hazardous wastes being disposed onsite. Debris and hazardous soil may be treated in accordance with the alternative standards.	Treatment of hazardous wastes, soils contaminated with hazardous waste, or debris containing hazardous waste onsite prior to shipment for offsite disposal	Applicable	Compliance with these standards is only required if hazardous waste is being treated prior to offsite disposal as non-hazardous waste or offsite disposal as hazardous waste that meets land disposal restrictions. The standard for the decontamination of debris will apply only to the specific type of debris encountered at the site. The alternative standards for the treatment of soil will treat only those COCs that are subject to treatment as described in 40 CFR 268.49(d). The universal treatment standards located at 40 CFR 268.48 will be used only in determining the appropriate treatment level required for contaminated soil. Only the substantive requirements of these regulations will be met to the extent that they are applicable to the circumstances above. OABG Alternative 3)

ARAR - Applicable or Relevant and Appropriate Requirements
CFR - Code of Federal Regulations
CSR - Code of State Regulations
COC - Constituent of Concern
RSLs - Regional Screening Levels
TCLP - toxicity characteristic leaching procedure
RCRA - Resource Conservation and Recovery Act
LDRs - land disposal restrictions
TBC - To be considered

TABLE B-2
Location-Specific Applicable or Relevant and Appropriate Requirements
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Location	Citation	Requirement	Prerequisites	Determination	Comments
Federal Location-Specific ARARs					
Areas where birds subject to the Migratory Bird Treaty Act are located	16 USC 703	Protects almost all species of native birds in the United States from unregulated taking.	Presence of migratory birds	Applicable	ABL is located in the Atlantic Migratory Flyway. If migratory birds, or their nests or eggs, are identified at Site 1, operations will not destroy the birds, nests or eggs. (ABG Alternative 2,OABG Alternatives 2 and 3)
West Virginia Location-Specific ARARs					
Within 100-year Floodplain	33 CSR 20-7.2 only as it incorporates 40 CFR 264.1(j)(7)	Facility must be designed, constructed, operated, and maintained to avoid washout if located within the 100 year floodplain.	Storage of hazardous waste in tanks, containers, or staging piles onsite.	Applicable	Portions of the site are within the 100-year flood zone. Applicable if hazardous waste is stored for more than 90 days or treated onsite during remediation. Relevant and appropriate to wastes accumulated onsite for 90 days or less. (ABG Alternative 2,OABG Alternatives 2 and 3)

ABL - Allegany Ballistics Laboratory
ARAR - Applicable or Relevant and Appropriate Requirements
CFR - Code of Federal Regulations
CSR - Code of State Regulations
USC - United States Code
RCRA - Resource Conservation and Recovery Act
PRB - permeable reactive barrier
TBC - To be considered
SWLF - solid waste landfills

TABLE B-3
Action-Specific Applicable or Relevant and Appropriate Requirements
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Action	Citation	Requirement	Prerequisite	Determination	Comments
Federal Action-Specific ARARs					
Discharge of dredge and fill to waters of the United States	40 CFR 230.10(d); 33 CFR 320.4(a), (b), (d), (p), (r)	No discharge of dredged or fill material will be allowed unless appropriate and practicable steps are taken that minimize potential adverse impacts of the discharge on the aquatic ecosystem.	Discharges of dredged or fill material to surface waters, including wetlands.	Applicable	Shoreline stabilization will involve disturbing the banks of the North Branch Potomac River by excavating and/or adding fill material; however the ecosystem will be enhanced through the action. If wetlands are permanently lost mitigation will be performed. Onsite CERCLA actions are not subject to administrative requirements such as permitting or administrative reviews and endorsements. (OABG Alternatives 2 and 3)
Storage of fuels and oils onsite	40 CFR 112.3(a)(1); 112.5; 112.6(a)(1), (a)(3)*; 112.7(a)(3)(i), (a)(3)(iv), (a)(3)(vi),(a)(4), (a)(5), (c), (e), (f),(g),(k); 112.8(b)(1), (b)(2), (c)(1), (c)(3), (c)(6), (c)(10), and (d)(4) *the provisions incorporated by reference here are not ARARs unless they are also listed in this table.	If storage capacity limits are exceeded a Spill, Prevention, Control, and Countermeasures Plan must be prepared and implemented with procedures, methods, equipment, and other requirements to prevent the discharge of into or upon the navigable waters of the United States.	Total onsite storage capacity exceeding 1,320 gallons in containers that are 55 gallons or larger in size.	Applicable	If the storage capacity in containers that are 55 gallons or greater is equal to or exceeds 1,320 gallons a Spill Prevention, Control, and Countermeasure (SPCC) Plan or its equivalent must be prepared and implemented. Containers include any drum or tank used to store any type of oil. oil filled equipment, and equipment fuel tanks. Onsite CERCLA actions are not subject to administrative requirements such as administrative reviews and endorsements. (ABG Alternative 2,OABG Alternatives 2 and 3)
West Virginia Action-Specific ARARs					
Erosion and Sediment control during land disturbance	Substantive requirements of the West Virginia NPDES General Permit for Stormwater Associated with Construction Activities. Permit No. WV0115924	Requirements for construction activity include the development of a stormwater pollution prevention plan that describes the temporary and permanent stormwater controls that will be implemented during the construction activity to prevent discharges of pollutants to surface waters.	Disturbance of greater than one acre of land during construction activities	Applicable	The cumulative total area of land that will be disturbed during the response action will exceed one acre. A stormwater pollution prevention plan or equivalent will be prepared and implemented during the response action. Onsite response actions taken under CERCLA are exempt from administrative requirements including obtaining coverage under the general permit as well as administrative reviews and approvals.

TABLE B-3
Action-Specific Applicable or Relevant and Appropriate Requirements
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Action	Citation	Requirement	Prerequisite	Determination	Comments
Hazardous waste accumulation and treatment in containers for less than 90 days	33 CSR 20-5.1 only as it incorporates 40 CFR 262.34(a)(1)(i), (2), (3), and 40 CFR 265.171-174	Hazardous waste may be accumulated and treated (except for thermal treatment) on site in containers for up to 90 days so long as the containers are in good condition, compatible with the waste being stored, and labeled with the words "Hazardous Waste" and the date that accumulation began. The containers must also be kept closed unless adding or removing waste and inspected weekly	Accumulate hazardous waste.	Applicable	If waste generated at ABL is determined to be hazardous, accumulation of the hazardous waste will not exceed 90 days.(ABG Alternative 2,OABG Alternatives 2 and 3)
Accumulation and/or treatment of hazardous waste in staging piles onsite	33 CSR 20-7.2 only as it incorporates 40 CFR 264.554(d)(1)(ii), (d)(2), (j)(1), and (j)(2)	A staging pile must me designed constructed and maintained to prevent the migration of hazardous constituents other media. The design must consider location, hydrogeology, and any other factors that may reasonably influence the migration of hazardous constituents. Closure requirements are also included in (j)(1) and (j)(2).	Accumulation or treatment of hazardous wastes in staging piles onsite	Applicable	Applicable for the design of piles to allow for temporary storage or exsitu treatment of remediation wastes characterized as hazardous waste before and/or after treatment. The substantive requirements will be complied with but a permit is not required. (OABG Alternative 3)
Treatment of hazardous waste in units	45 CSR 25-4.3	Provides requirements for the facility design, construction, maintenance, and operation to minimize the release of hazardous waste constituents, toxic mists, fumes, dusts, or gases to the air.	Onsite hazardous waste treatment	Applicable	Staging Piles used for the treatment of hazardous wastes will be designed and operated to meet these standards. (OABG Alternative 3).
Generation of fugitive dust	45 CSR 17-3.1	Particulate matter emissions are not allowed beyond the boundary of the property on which they originate	Generation of dust	Applicable	Actions will be taken to control dust emissions during construction. (ABG Alternative 2,OABG Alternatives 2 and 3)
Discharge to waters of the State (including groundwater)	47 CSR 2-3.2	Lists adverse conditions not allowed in State waters, (including groundwater) which must be prevented during remediation.	Potential adverse affects to groundwater or surface water from solid wastes or material stored at the site.	Applicable	Solid wastes and materials (including soil stockpiled for cover) that are stored at the site during remedial actions will be managed so as not to impact the waters of the State via leachate, runoff, or discharge. (ABG Alternative 2,OABG Alternatives 2 and 3)
Site closure with waste in place	33 CSR 1-6.1.f.1 through 3	Final Use. The following activities are prohibited at closed landfills: • Agricultural use • Construction of buildings • Excavation of the final cover or waste materials.	Closure of landfills	Relevant and appropriate	Relevant and appropriate for remediation sites where wastes are left in place. Institutional Controls will be designed to meet these requirements.(ABG Alternative 2,OABG Alternatives 2 and 3)

TABLE B-3
Action-Specific Applicable or Relevant and Appropriate Requirements
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Action	Citation	Requirement	Prerequisite	Determination	Comments
Soil boring / Well construction and abandonment	47 CSR 58-4.2	Subsurface borings shall be constructed, operated, and closed in a manner that protects groundwater	Construction of soil borings, monitoring wells, or injection wells	Applicable	Soil borings and monitoring wells that are installed, operated, or abandoned during the response action will meet this standard. (ABG Alternative 2,OABG Alternatives 2 and 3)
Outdoor material storage or disposal activities	47 CSR 58-4.3.b	New areas used for storage shall be designed, constructed and operated to prevent release of contaminants. Groundwater monitoring stations may be necessary to assure protection of the groundwater resource.	Storage of chemicals or oils/fuels onsite during treatment activities	Applicable	Applicable if chemicals are used for treatment or oils/fuels are stored during remediation.(ABG Alternative 2,OABG Alternatives 2 and 3)

ABL - Allegany Ballistics Laboratory

ARAR - Applicable or Relevant and Appropriate Requirements

CAMU - Corrective Action Management Unit

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

CFR - Code of Federal Regulations

CSR - Code of State Regulations

NPDES - National Pollutant Discharge Elimination System

POTW - Publically Owned Treatment Works (wastewater)

PRB - permeable reactive barrier

RCRA - Resource Conservation and Recovery Act

TSDF - hazardous waste Treatment, Storage, and/or Disposal Facility

Appendix C
Cost Estimate

Table C-1
Project Summary
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

ABG Remedial Alternative Summary	Alternative #1 No Action	Alternative #2 Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
Construction Time (Weeks)	0	5
Operation Time (Years)	0	0
Capitol Costs	$0.00	$718,695.35
Present Worth O&M Costs	$0.00	$0.00
Total Present Worth	$0.00	$718,695.35
+50% Range	$0.00	$1,078,043.02
-30% Range	$0.00	$503,086.74

OABG Remedial Alternative Summary	Alternative #1 No Action	Alternative #2 Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt	Alternative #3 Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt
Construction Time (Weeks)	0	24	33
Operation Time (Years)	0	30	30
Capitol Costs	$0.00	$10,194,241.46	$8,334,872.02
Present Worth O&M Costs	$0.00	$210,862.23	$210,862.23
Total Present Worth	$0.00	$10,405,103.69	$8,545,734.26
+50% Range	$0.00	$15,607,655.54	$12,818,601.39
-30% Range	$0.00	$7,283,572.59	$5,982,013.98

Table C-2
Basis of Estimate
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

GENERAL ASSUMPTIONS
1. Basis for ABG/OABG Remediation Cost Summary
2. Craft Labor Rates based on General Decision Number: WV130053 02/15/2013 WV53
PROJECT ASSUMPTIONS
1. QUANTIY ASSUMPTIONS
a. The volume of contaminated soil in the FDPs consists of the residual contamination left in place after their removal. The uncertainty of residual contamination cannot be estimated and is assumed 0 CY.
b. For the purpose of this FS, the vertical extent of the AOCs is based on current data and historical knowledge of the site. The assumed vertical extent of the AOCs within the ABG is 5 feet bgs. The assumed vertical extent of the AOCs within the West OABG and East OABG is 10 feet bgs and 12 feet bgs, respectively.
c. Taken from the Debris Characterization Technical Memorandum (CH2M HILL, 2008). Although the depth of debris may extent as deep as 12 feet, the assumed excavation depth in the West OABG is 10 feet bgs. Therefore, the debris volume and contaminated volume was calculated using 10 foot depth.
d. For the purpose of the FS, it is assumed that 50 percent of the comingled areas is chemically contaminated soil and 50 percent is debris.
f. Soil is assumed to be hazardous in nature where TCE concentrations exceed 10 mg/kg.
g. Although the characteristic nature of the debris is unknown, it is known that there is asbestos contaminated material associated with construction debris present in the subsurface. For the purposes of the FS, it is assumed that 5% of construction debris identified in OABG AOCs 3 and 7 will be deemed hazardous.
h. LTM costs for the groundwater are assumed to be reflected in the framework of the current GW LTM as a separate OU.
i. Surfice debris being removed from the OABG is estimated to be 5 times of that removed in the 2008 effort.
items.
2. PROJECT EXECUTION
a. Project Submittals include Project Management Plan, HASP Plan, and Erosion & Sediment Control Plan
b. Mobilization Includes:
i. Personnel Mobilization
ii. Equipment Mobilization
iii. Access Road Provisions
iv. Staging Area Provisions
c. Erosion & Sediment Controls Include:
i. Silt Fence & Hay Bales ABG & OABG
ii. Jersey Barrier with Poly Covering at OABG (shoreline)
d. Earthwork:
i. Quantities Based On Assumptions Listed Above
ii. Excavated Soil To Be Staged in Roll-Offs and Sampled Prior To Off-Site Shipment (ABG)
iii. Excavated Soil To Be Screened Prior To Being Staged in Roll-Offs. Soil Will Then Be Sampled Prior to Off-Site Shipment (OABG)
iv. Backfill to be Imported From Off-Site Source
v. Backfill will be compacted to 90% at ABG, Surveyor and Compaction Testing Included in Costs
vi. Backfill will be compacted to 80% at OABG, Survey Included in Costs
vii. Restoration Costs for ABG Include 6" of Topsoil Placement, seeding, and mulching.
viii. Restoration Costs for OABG includes sustainable bank restoration, floodplains in AOCs 3 and 7, and protective plantings throughout
e. Transportation & Disposal:
i. All Soil at ABG is Non-Hazardous
ii. Soil and Debris at OABG is broken down into Non-Hazardous and Hazardous components
iii. Quantities Based On Assumptions Listed Above
f. Demobilization Includes:
i. Personnel Demobilization
ii. Equipment Demobilization
iii. Access Road Removal
iv. Staging Area Removal

Table C-3
Quantities
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

ABG Remedial Alternative Quantity Summary

AOC	Aerial Extent of Contaminated Soil (sf)	Depth of Contaminated Soil[2] (ft)	Volume of Contaminated Soil[3] (CY)	Volume of Contaminated Soil Assumed to be Hazardous[6] (CY)	Length[7]	Width[7]	Over Excavation (CY)	Total Excavation Volume (CY)
1	314.16	5.00	58.18	0.00	17.72	17.72	19.69	77.87
2	1,055.13	5.00	195.39	0.00	32.48	32.48	36.09	231.49
3	1,425.38	5.00	263.96	0.00	37.75	37.75	41.95	305.91
4	1,425.38	5.00	263.96	0.00	37.75	37.75	41.95	305.91
5	1,425.38	5.00	263.96	0.00	37.75	37.75	41.95	305.91
6	1,425.38	5.00	263.96	0.00	37.75	37.75	41.95	305.91
TOTALS	7,070.81		1,309.41	0.00			223.58	1,532.99

OABG Remedial Alternative Quantity Summary

AOC	Depth of Contaminated Soil[3] (ft)	Aerial Extent of Contaminated Soil (sf)	Depth of Subsurface Debris[3] (ft)	Aerial Extent of Debris (sf)	Volume of Subsurface Debris[5] (CY)	Volume of Contaminated Soil[4] (CY)	Volume of Contaminated Soil Assumed to be Hazardous[5] (CY)	Over Excavation (CY)	Total Excavation Volume	Volume of Debris[5] (CY)
1	10.00	314.16	6.00	59.32	6.59	109.76	0.00	76.51	186.28	6.59
2	10.00	1,441.88	12.00	1,441.88	267.01	267.01	56.46	119.33	386.35	267.01
3	10.00	9,187.91	3.00	260.62	421.11	2,981.82	1,663.09	398.79	3,380.61	421.11
			6.00	489.55						
			9.00	2,113.44						
4	10.00	698.54	3.00	259.30	14.41	244.31	100.32	114.15	358.46	14.41
5	10.00	3,213.45	3.00	109.38	6.08	1,184.09	674.03	251.30	1,435.39	6.08
6	12.00	6,582.59	na	na	0.00	2,925.60	1,396.69	432.71	3,358.31	na
7	12.00	18,576.15	6.00	4,156.89	1,742.89	6,513.18	5,376.81	645.63	7,158.81	1,742.89
			9.00	7,686.09						
8	12.00	314.16	12.00	164.70	36.60	103.03	0.00	81.20	184.23	36.60
9	10.00	314.16	6.00	70.55	48.44	67.92	0.00	85.80	153.72	48.44
			9.00	243.61						
10	10.00	314.16	6.00	270.46	38.14	78.21	0.00	64.59	142.80	38.14
			12.00	43.70						
11	10.00	314.16	6.00	314.16	34.91	81.45	0.00	65.91	147.36	34.91
TOTALS		41,271.32		17,683.65	2,616.18	14,556.37	9,267.41	2,335.93	16,892.30	2,616.18

Notes

1 The volume of contaminated soil in the FDPs consists of the residual contamination left in place after their removal. For the purposes of this FS, the uncertainty of residual contamination cannot be estimated and is assumed 0 CY.

2. For the purpose of this FS, the vertical extent of the AOCs is based on current data and historical knowledge of the site. The assumed vertical extent of the AOCs within the ABG is 5 feet bgs. The assumed vertical extent of the AOCs within the West OABG and East OABG is 10 feet bgs and 12 feet bgs, respectively.

3 Taken from the Debris Characterization Technical Memorandum (CH2M HILL, 2008). Although the depth of debris may extent as deep as 12 feet, the assumed excavation depth in the West OABG is 10 feet bgs. Therefore, the debris volume and contaminated volume was calculated using 10 foot depth.

4 For the purpose of the FS, it is assumed that 50 percent of the comingled areas is chemically contaminated soil and 50 percent is debris.

5 Soil is assumed to be hazardous in nature where TCE concentrations exceed 10 mg/kg.

6 Although the characteristic nature of the debris is unknown, it is known that there is asbestos contaminated material associated with construction debris present in the subsurface. For the purposes of the FS, it is assumed that 5% of construction debris identified in OABG subareas 3 and 7 will be deemed hazardous.

7. Calculation used to estimate 2:1 Slopes needed for excavation sidewall/excavation stability.

ABG - active burning ground
AOC - area of concern
CY - cubic yards
FDP - former disposal pit
ft - feet
na - not applicable
sf - square feet

Table C-4
ABG Cost Summary
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

ABG Remedial Alternative Summary		
COST ELEMENTS	Alternative #1	Alternative #2
	No Action	Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
Project Administration	$0.00	$137,134.03
Project Mobilization/Set-Up/Demobilization	$0.00	$174,111.29
Earthwork	$0.00	$407,450.03
Excavation	$0.00	$44,454.10
Backfill	$0.00	$94,861.01
Survey/Compaction	$0.00	$20,312.08
Restoration	$0.00	$24,748.62
Transportation & Disposal	$0.00	$223,074.22
Land Use Controls	$0.00	$0.00
Long Term Management	$0.00	$0.00
TOTAL	$0.00	$718,695.35

Table C-5
ABG Alternative 2 (Excavation of AOCs, Offsite Disposa, LUCs, and LTMgt) Cost Detail
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

ITEM No.	PAY ITEM DESCRIPTION	Work Item	QUANTITY	UNIT	UNIT PRICE	COST	PRIME G&A/OH	CONTRACTOR G&A/OH	FEE	TOTAL	ESTIMATED DURATION (DAYS)	COMMENTS
1	ABG Submittals	Project Submittals	1	LS	$32,380.59	$15,865.02	$12,292.02	$0.00	$4,223.56	$32,380.59	10	COMMENT
2	ABG Mobilization	Site Mobilization	1	LS	$121,094.37	$96,651.27	$259.53	$8,388.65	$15,794.92	$121,094.37	1	COMMENT
3	ABG General Conditions	General Conditions	1	LS	$5,554.50	$4,200.00	$0.00	$630.00	$724.50	$5,554.50	1	COMMENT
4	E&S Control	E&S Controls	1	LS	$16,750.26	$12,665.60	$0.00	$1,899.84	$2,184.82	$16,750.26	2	COMMENT
5	AOC 1 Excavation	Excavation: Contaminated Soil	58	CY	$30.90	$1,359.51	$0.00	$203.93	$234.51	$1,797.95	1	COMMENT
6	AOC 1 Excavation	Excavation: Over Excavation	20	CY	$23.35	$347.68	$0.00	$52.15	$59.98	$459.81	1	COMMENT
7	AOC 1 Backfill	Backfill	101	CY	$51.01	$3,904.36	$0.00	$585.65	$673.50	$5,163.52	1	COMMENT
8	AOC 1 Survey/Compaction Testing	Survey/Compaction Testing	1	LS	$1,191.29	$990.68	$49.53	$2.48	$148.60	$1,191.29	1	COMMENT
9	AOC 1 Restoration	Restoration	2,814	SF	$3.08	$6,559.99	$0.00	$984.00	$1,131.60	$8,675.59	1	COMMENT
10	AOC 1 Transportation & Disposal	T&D	73	TON	$141.34	$7,772.22	$0.00	$1,165.83	$1,340.71	$10,278.76	1	COMMENT
11	AOC 2 Excavation	Excavation: Contaminated Soil	195	CY	$43.05	$6,360.31	$0.00	$954.05	$1,097.15	$8,411.51	1	COMMENT
12	AOC 2 Excavation	Excavation: Over Excavation	36	CY	$22.52	$614.51	$0.00	$92.18	$106.00	$812.68	1	COMMENT
13	AOC 2 Backfill	Backfill	301	CY	$47.42	$10,789.75	$0.00	$1,618.46	$1,861.23	$14,269.44	2	COMMENT
14	AOC 2 Survey/Compaction Testing	Survey/Compaction Testing	1	LS	$3,024.22	$2,514.95	$125.75	$6.29	$377.24	$3,024.22	2	COMMENT
15	AOC 2 Restoration	Restoration	1,055	SF	$2.38	$1,897.91	$0.00	$284.69	$327.39	$2,509.99	1	COMMENT
16	AOC 2 Transportation & Disposal	T&D	244	TON	$134.96	$24,924.31	$0.00	$3,738.65	$4,299.44	$32,962.39	1	COMMENT
17	AOC 3 Excavation	Excavation: Contaminated Soil	264	CY	$22.52	$4,494.20	$0.00	$674.13	$775.25	$5,943.58	1	COMMENT
18	AOC 3 Excavation	Excavation: Over Excavation	42	CY	$22.52	$714.23	$0.00	$107.13	$123.20	$944.57	1	COMMENT
19	AOC 3 Backfill	Backfill	398	CY	$47.42	$14,258.61	$0.00	$2,138.79	$2,459.61	$18,857.01	2	COMMENT
20	AOC 3 Survey/Compaction Testing	Survey/Compaction Testing	1	LS	$4,024.14	$3,346.48	$167.32	$8.37	$501.97	$4,024.14	3	COMMENT
21	AOC 3 Restoration	Restoration	1,425	SF	$2.38	$2,563.90	$0.00	$384.59	$442.27	$3,390.76	1	COMMENT
22	AOC 3 Transportation & Disposal	T&D	330	TON	$136.26	$33,994.91	$0.00	$5,099.24	$5,864.12	$44,958.27	1	COMMENT
23	AOC 4 Excavation	Excavation: Contaminated Soil	264	CY	$22.52	$4,494.20	$0.00	$674.13	$775.25	$5,943.58	1	COMMENT
24	AOC 4 Excavation	Excavation: Over Excavation	42	CY	$22.52	$714.23	$0.00	$107.13	$123.20	$944.57	1	COMMENT
25	AOC 4 Backfill	Backfill	398	CY	$47.42	$14,258.61	$0.00	$2,138.79	$2,459.61	$18,857.01	2	COMMENT
26	AOC 4 Survey/Compaction Testing	Survey/Compaction Testing	1	LS	$4,024.14	$3,346.48	$167.32	$8.37	$501.97	$4,024.14	3	COMMENT
27	AOC 4 Restoration	Restoration	1,425	SF	$2.38	$2,563.90	$0.00	$384.59	$442.27	$3,390.76	1	COMMENT
28	AOC 4 Transportation & Disposal	T&D	330	TON	$136.26	$33,994.91	$0.00	$5,099.24	$5,864.12	$44,958.27	1	COMMENT
29	AOC 5 Excavation	Excavation: Contaminated Soil	264	CY	$43.05	$8,592.17	$0.00	$1,288.83	$1,482.15	$11,363.14	1	COMMENT
30	AOC 5 Excavation	Excavation: Over Excavation	42	CY	$22.52	$714.23	$0.00	$107.13	$123.20	$944.57	1	COMMENT
31	AOC 5 Backfill	Backfill	398	CY	$47.42	$14,258.61	$0.00	$2,138.79	$2,459.61	$18,857.01	2	COMMENT
32	AOC 5 Survey/Compaction Testing	Survey/Compaction Testing	1	LS	$4,024.14	$3,346.48	$167.32	$8.37	$501.97	$4,024.14	3	COMMENT
33	AOC 5 Restoration	Restoration	1,425	SF	$2.38	$2,563.90	$0.00	$384.59	$442.27	$3,390.76	1	COMMENT
34	AOC 5 Transportation & Disposal	T&D	330	TON	$136.26	$33,994.91	$0.00	$5,099.24	$5,864.12	$44,958.27	1	COMMENT
35	AOC 6 Excavation	Excavation: Contaminated Soil	264	CY	$22.52	$4,494.20	$0.00	$674.13	$775.25	$5,943.58	1	COMMENT
36	AOC 6 Excavation	Excavation: Over Excavation	42	CY	$22.52	$714.23	$0.00	$107.13	$123.20	$944.57	1	COMMENT
37	AOC 6 Backfill	Backfill	398	CY	$47.42	$14,258.61	$0.00	$2,138.79	$2,459.61	$18,857.01	2	COMMENT
38	AOC 6 Survey/Compaction Testing	Survey/Compaction Testing	1	LS	$4,024.14	$3,346.48	$167.32	$8.37	$501.97	$4,024.14	3	COMMENT
39	AOC 6 Restoration	Restoration	1,425	SF	$2.38	$2,563.90	$0.00	$384.59	$442.27	$3,390.76	1	COMMENT
40	AOC 6 Transportation & Disposal	T&D	330	TON	$136.26	$33,994.91	$0.00	$5,099.24	$5,864.12	$44,958.27	1	COMMENT
41	ABG Demobilization	Site Demobilization	1	LS	$36,266.66	$27,250.21	$259.53	$4,026.50	$4,730.43	$36,266.66	1	COMMENT
42	LUC Remedial Design	LUC Remedial Design	1	LS	$26,925.52	$13,096.39	$10,317.11	$0.00	$3,512.02	$26,925.52	10	COMMENT
43	Site-Specific LUC	Site-Specific LUC	0	LS	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	1	COMMENT
44	Completion Report	Completion Report	1	LS	$27,532.91	$22,896.39	$1,144.82	$57.24	$3,434.46	$27,532.91	10	COMMENT
45	Project Management	Project Management	1	LS	$44,740.51	$37,206.24	$1,860.31	$93.02	$5,580.94	$44,740.51	11	COMMENT

Table C-6
OABG Cost Summary
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

OABG Remedial Alternative Summary			
COST ELEMENTS	Alternative #1	Alternative #2	Alternative #3
	No Action	Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt	Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs, and LTMgt
Project Administration	$0.00	$572,098.39	$788,517.06
Project Mobilization/Set-Up	$0.00	$661,547.13	$773,170.25
Earthwork	$0.00	$8,960,595.94	$6,773,184.71
Excavation	$0.00	$222,982.88	$222,982.88
Soil Screening	$0.00	$269,676.89	$269,676.89
Backfill	$0.00	$670,997.98	$670,997.98
Survey	$0.00	$63,321.81	$63,321.81
Restoration	$0.00	$987,356.21	$987,356.21
Ex-Situ Treatment	$0.00	$0.00	$1,294,952.60
Transportation & Disposal	$0.00	$6,746,260.17	$3,263,896.34
Land Use Controls	$0.00	$0.00	$0.00
Long Term Management	$0.00	$210,862.23	$210,862.23
TOTAL	$0.00	$10,405,103.69	$8,545,734.26

Table C-7
OABG Alternative 2 (Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt) Cost Summary
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

ITEM No.	PAY ITEM DESCRIPTION	Work Item	QUANTITY	UNIT	UNIT PRICE	COST	PRIME G&A/OH	CONTRACTOR G&A/OH	FEE	TOTAL	ESTIMATED DURATION (DAYS)	COMMENTS
1	OABG Submittals	Project Submittals	1	LS	$39,770.46	$19,435.00	$15,148.00	$0.00	$5,187.45	$39,770.46	10	COMMENT
2	OABG Mobilization	Site Mobilization	1	LS	$502,853.47	$412,320.62	$1,132.21	$23,811.05	$65,589.58	$502,853.47	5	COMMENT
3	OABG General Conditions	General Conditions	1	LS	$27,772.50	$21,000.00	$0.00	$3,150.00	$3,622.50	$27,772.50	1	COMMENT
4	E&S Controls	E&S Controls	1	LS	$117,673.97	$88,978.43	$0.00	$13,346.76	$15,348.78	$117,673.97	3	COMMENT
5	AOC 1 Excavation	Excavation	193	CY	$19.03	$2,774.59	$0.00	$416.19	$478.62	$3,669.40	1	COMMENT
6	AOC 1 Soil Screening	Soil Screening	241	CY	$13.79	$2,142.13	$525.98	$222.70	$433.62	$3,324.43	1	COMMENT
7	AOC 1 Backfill	Backfill	251	CY	$48.70	$9,231.99	$0.00	$1,384.80	$1,592.52	$12,209.31	1	COMMENT
8	AOC 1 Survey	Survey	1	LS	$1,428.65	$1,188.06	$59.40	$2.97	$178.21	$1,428.65	2	COMMENT
9	AOC 1 Restoration	Restoration	393	SF	$4.31	$1,278.78	$0.00	$191.82	$220.59	$1,691.18	1	COMMENT
10	AOC 1 Transportation & Disposal	T&D	243	TON	$132.65	$24,346.00	$0.00	$3,651.90	$4,199.68	$32,197.58	1	COMMENT
11	AOC 2 Excavation	Excavation	653	CY	$19.03	$9,399.30	$0.00	$1,409.90	$1,621.38	$12,430.57	2	COMMENT
12	AOC 2 Soil Screening	Soil Screening	653	CY	$13.79	$5,805.41	$1,425.46	$603.54	$1,175.16	$9,009.56	1	COMMENT
13	AOC 2 Backfill	Backfill	849	CY	$48.78	$31,329.19	$0.00	$4,699.38	$5,404.29	$41,432.86	2	COMMENT
14	AOC 2 Survey	Survey	1	LS	$4,839.73	$4,024.72	$201.24	$10.06	$603.71	$4,839.73	4	COMMENT
15	AOC 2 Restoration	Restoration	1,802	SF	$0.12	$161.91	$0.00	$24.29	$27.93	$214.13	1	COMMENT
16	AOC 2 Transportation & Disposal	T&D	883	TON	$147.91	$98,808.19	$0.00	$14,821.23	$17,044.41	$130,673.83	1	COMMENT
17	AOC 3 Excavation	Excavation	3,802	CY	$11.89	$34,182.21	$0.00	$5,127.33	$5,896.43	$45,205.97	6	COMMENT
18	AOC 3 Soil Screening	Soil Screening	3,802	CY	$13.79	$33,779.81	$8,294.29	$3,511.79	$6,837.88	$52,423.78	5	COMMENT
19	AOC 3 Backfill	Backfill	1,794	CY	$41.46	$56,256.87	$0.00	$8,438.53	$9,704.31	$74,399.71	8	COMMENT
20	AOC 3 Survey	Survey	1	LS	$8,591.41	$7,144.62	$357.23	$17.86	$1,071.69	$8,591.41	13	COMMENT
21	AOC 3 Restoration	Restoration	11,485	SF	$0.12	$1,031.73	$0.00	$154.76	$177.97	$1,364.46	2	COMMENT
22	AOC 3 Transportation & Disposal	T&D	4,857	TON	$280.06	$1,028,639.45	$0.00	$154,295.92	$177,440.30	$1,360,375.67	3	COMMENT
23	AOC 4 Excavation	Excavation	373	CY	$19.03	$5,364.07	$0.00	$804.61	$925.30	$7,093.99	1	COMMENT
24	AOC 4 Soil Screening	Soil Screening	373	CY	$13.79	$3,313.08	$813.49	$344.43	$670.65	$5,141.65	1	COMMENT
25	AOC 4 Backfill	Backfill	485	CY	$48.78	$17,880.47	$0.00	$2,682.07	$3,084.38	$23,646.93	2	COMMENT
26	AOC 4 Survey	Survey	1	LS	$2,761.98	$2,296.86	$114.84	$5.74	$344.53	$2,761.98	3	COMMENT
27	AOC 4 Restoration	Restoration	873	SF	$0.12	$78.44	$0.00	$11.77	$13.53	$103.74	1	COMMENT
28	AOC 4 Transportation & Disposal	T&D	470	TON	$226.06	$80,284.11	$0.00	$12,042.62	$13,849.01	$106,175.74	1	COMMENT
29	AOC 5 Excavation	Excavation	1,441	CY	$11.89	$12,960.58	$0.00	$1,944.09	$2,235.70	$17,140.37	2	COMMENT
30	AOC 5 Soil Screening	Soil Screening	1,441	CY	$13.79	$12,808.01	$3,144.88	$1,331.54	$2,592.66	$19,877.08	2	COMMENT
31	AOC 5 Backfill	Backfill	1,874	CY	$39.04	$55,322.70	$0.00	$8,298.41	$9,543.17	$73,164.28	4	COMMENT
32	AOC 5 Survey	Survey	1	LS	$5,171.20	$4,300.37	$215.02	$10.75	$645.06	$5,171.20	6	COMMENT
33	AOC 5 Restoration	Restoration	1,425	SF	$1.27	$1,371.55	$0.00	$205.73	$236.59	$1,813.87	1	COMMENT
34	AOC 5 Transportation & Disposal	T&D	1,803	TON	$297.49	$405,650.27	$0.00	$60,847.54	$69,974.67	$536,472.49	2	COMMENT
35	AOC 6 Excavation	Excavation	3,358	CY	$11.89	$30,195.36	$0.00	$4,529.30	$5,208.70	$39,933.37	6	COMMENT
36	AOC 6 Soil Screening	Soil Screening	3,358	CY	$13.79	$29,839.89	$7,326.89	$3,102.19	$6,040.35	$46,309.32	6	COMMENT
37	AOC 6 Backfill	Backfill	4,366	CY	$39.04	$128,889.98	$0.00	$19,333.50	$22,233.52	$170,456.99	8	COMMENT
38	AOC 6 Survey	Survey	1	LS	$12,047.78	$10,018.94	$500.95	$25.05	$1,502.84	$12,047.78	14	COMMENT
39	AOC 6 Restoration	Restoration	8,228	SF	$0.12	$739.17	$0.00	$110.88	$127.51	$977.56	1	COMMENT
40	AOC 6 Transportation & Disposal	T&D	4,198	TON	$142.09	$451,028.08	$0.00	$67,654.21	$77,802.34	$596,484.64	3	COMMENT
41	AOC 7 Excavation	Excavation	8,902	CY	$9.06	$60,982.19	$0.00	$9,147.33	$10,519.43	$80,648.94	9	COMMENT
42	AOC 7 Soil Screening	Soil Screening	8,902	CY	$13.79	$79,095.15	$19,421.02	$8,222.83	$16,010.85	$122,749.86	9	COMMENT
43	AOC 7 Backfill	Backfill	5,786	CY	$39.04	$170,821.19	$0.00	$25,623.18	$29,466.65	$225,911.02	16	COMMENT
44	AOC 7 Survey	Survey	1	LS	$22,657.41	$18,841.92	$942.10	$47.10	$2,826.29	$22,657.41	25	COMMENT
45	AOC 7 Restoration	Restoration	23,220	SF	$0.33	$5,816.45	$0.00	$872.47	$1,003.34	$7,692.26	3	COMMENT
46	AOC7 Transportation & Disposal	T&D	11,563	TON	$330.95	$2,893,559.20	$0.00	$434,033.88	$499,138.96	$3,826,732.04	12	COMMENT
47	AOC 8 Excavation	Excavation	221	CY	$19.03	$3,176.81	$0.00	$476.52	$548.00	$4,201.33	1	COMMENT
48	AOC 8 Soil Screening	Soil Screening	221	CY	$13.79	$1,962.13	$481.78	$203.99	$397.19	$3,045.09	1	COMMENT
49	AOC 8 Backfill	Backfill	287	CY	$48.70	$10,571.93	$0.00	$1,585.79	$1,823.66	$13,981.37	1	COMMENT
50	AOC 8 Survey	Survey	1	LS	$1,635.75	$1,360.29	$68.01	$3.40	$204.04	$1,635.75	2	COMMENT
51	AOC 8 Restoration	Restoration	393	SF	$0.12	$35.28	$0.00	$5.29	$6.09	$46.65	1	COMMENT
52	AOC 8 Transportation & Disposal	T&D	285	TON	$127.96	$27,594.00	$0.00	$4,139.10	$4,759.96	$36,493.06	1	COMMENT
53	AOC 9 Excavation	Excavation	202	CY	$19.03	$2,908.21	$0.00	$436.23	$501.67	$3,846.11	1	COMMENT
54	AOC 9 Soil Screening	Soil Screening	202	CY	$13.79	$1,796.23	$441.05	$186.74	$363.60	$2,787.62	1	COMMENT
55	AOC 9 Backfill	Backfill	263	CY	$48.70	$9,678.06	$0.00	$1,451.71	$1,669.47	$12,799.23	1	COMMENT
56	AOC 9 Survey	Survey	1	LS	$1,497.45	$1,245.28	$62.26	$3.11	$186.79	$1,497.45	2	COMMENT
57	AOC 9 Restoration	Restoration	393	SF	$0.12	$35.28	$0.00	$5.29	$6.09	$46.65	1	COMMENT
58	AOC 9 Transportation & Disposal	T&D	265	TON	$125.44	$25,116.29	$0.00	$3,767.44	$4,332.56	$33,216.29	1	COMMENT
59	AOC 10 Excavation	Excavation	181	CY	$19.03	$2,603.08	$0.00	$390.46	$449.03	$3,442.58	1	COMMENT
60	AOC10 Soil Screening	Soil Screening	181	CY	$13.79	$1,607.77	$394.77	$167.15	$325.45	$2,495.15	1	COMMENT
61	AOC 10 Backfill	Backfill	235	CY	$48.70	$8,662.65	$0.00	$1,299.40	$1,494.31	$11,456.35	1	COMMENT

Table C-7
OABG Alternative 2 (Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt) Cost Summary
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

ITEM No.	PAY ITEM DESCRIPTION	Work Item	QUANTITY	UNIT	UNIT PRICE	COST	PRIME G&A/OH	CONTRACTOR G&A/OH	FEE	TOTAL	ESTIMATED DURATION (DAYS)	COMMENTS
62	AOC 10 Survey	Survey	1	LS	$1,340.34	$1,114.62	$55.73	$2.79	$167.19	$1,340.34	2	COMMENT
63	AOC 10 Restoration	Restoration	393	SF	$0.12	$35.28	$0.00	$5.29	$6.09	$46.65	1	COMMENT
64	AOC10 Transportation & Disposal	T&D	236	TON	$126.41	$22,531.60	$0.00	$3,379.74	$3,886.70	$29,798.04	1	COMMENT
65	AOC 11 Excavation	Excavation	182	CY	$19.03	$2,622.07	$0.00	$393.31	$452.31	$3,467.69	1	COMMENT
66	AOC 11 Soil Screening	Soil Screening	182	CY	$13.79	$1,619.50	$397.65	$168.37	$327.83	$2,513.35	1	COMMENT
67	AOC 11 Backfill	Backfill	237	CY	$48.70	$8,725.84	$0.00	$1,308.88	$1,505.21	$11,539.92	1	COMMENT
68	AOC 11 Survey	Survey	1	LS	$1,350.11	$1,122.76	$56.14	$2.81	$168.41	$1,350.11	2	COMMENT
69	AOC 11 Restoration	Restoration	393	SF	$0.12	$35.28	$0.00	$5.29	$6.09	$46.65	1	COMMENT
70	AOC 11 Transportation & Disposal	T&D	237	TON	$127.07	$22,730.00	$0.00	$3,409.50	$3,920.93	$30,060.43	1	COMMENT
71	Riverbank, Western Ditch, and Site Restoration	Riverbank, Western Ditch, and Site Restoration	1	LS	$971,886.74	$734,886.00	$0.00	$110,232.90	$126,767.84	$971,886.74	20	COMMENT
72	Western Drainage Ditch	Excavation (Soil)	50	CY	$19.03	$719.30	$0.00	$107.90	$124.08	$951.27	1	COMMENT
73	Western Drainage Ditch	Debris Removal	50	CY	$19.03	$719.30	$0.00	$107.90	$124.08	$951.27	1	COMMENT
74	Western Drainage Ditch T&D	T&D	138	TON	$117.07	$12,172.13	$0.00	$1,825.82	$2,099.69	$16,097.64	1	COMMENT
75	Western Drainage Ditch Restoration	Restoration	5,000	SF	$0.29	$1,078.00	$0.00	$161.70	$185.96	$1,425.66	1	COMMENT
76	OABG Surface Debris T&D	Debris Removal	215	TON	$53.40	$8,682.60	$0.00	$1,302.39	$1,497.75	$11,482.74	2	COMMENT
77	OABG Demobilization	Site Demobilization	1	LS	$41,019.69	$30,238.37	$1,132.21	$4,298.72	$5,350.39	$41,019.69	5	COMMENT
78	LUC Remedial Design	LUC Remedial Design	1	LS	$26,925.52	$13,096.39	$10,317.11	$0.00	$3,512.02	$26,925.52	10	COMMENT
79	Completion Report	Completion Report	1	LS	$30,214.66	$25,126.53	$1,256.33	$62.82	$3,768.98	$30,214.66	10	COMMENT
80	Explosive Safety Report	Explosive Safety Report	1	LS	$39,293.33	$32,676.36	$1,633.82	$81.69	$4,901.45	$39,293.33	10	COMMENT
81	Project Management	Project Management	1	LS	$408,121.92	$339,394.53	$16,969.73	$848.49	$50,909.18	$408,121.92	32	COMMENT

Table C-8
OABG Alternative 3 (Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs, and LTMgt) Cost Summary
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

ITEM No.	PAY ITEM DESCRIPTION	Work Item	QUANTITY	UNIT	UNIT PRICE	COST	PRIME G&A/OH	CONTRACTOR G&A/OH	FEE	TOTAL	ESTIMATED DURATION (DAYS)	COMMENTS
1	OABG Submittals	Project Submittals	1	LS	$39,770.46	$19,435.00	$15,148.00	$0.00	$5,187.45	$39,770.46	10	COMMENT
2	OABG Mobilization	Site Mobilization	1	LS	$613,154.09	$508,049.82	$1,132.21	$23,995.43	$79,976.62	$613,154.09	5	COMMENT
3	OABG General Conditions	General Conditions	1	LS	$30,549.75	$23,100.00	$0.00	$3,465.00	$3,984.75	$30,549.75	1	COMMENT
4	Erosion Control/Staging Area	E&S Controls	1	LS	$117,673.97	$88,978.43	$0.00	$13,346.76	$15,348.78	$117,673.97	3	COMMENT
5	AOC 1 Excavation	Excavation	193	CY	$19.03	$2,774.59	$0.00	$416.19	$478.62	$3,669.40	1	COMMENT
6	AOC 1 Soil Screening	Soil Screening	241	CY	$13.79	$2,142.13	$525.98	$222.70	$433.62	$3,324.43	1	COMMENT
8	AOC 1 Backfill	Backfill	251	CY	$48.70	$9,231.99	$0.00	$1,384.80	$1,592.52	$12,209.31	1	COMMENT
9	AOC 1 Survey	Survey	1	LS	$1,428.65	$1,188.06	$59.40	$2.97	$178.21	$1,428.65	2	COMMENT
10	AOC 1 Restoration	Restoration	393	SF	$4.31	$1,278.78	$0.00	$191.82	$220.59	$1,691.18	1	COMMENT
11	AOC 1 Transportation & Disposal	T&D	243	TON	$132.65	$24,346.00	$0.00	$3,651.90	$4,199.68	$32,197.58	1	COMMENT
12	AOC 2 Excavation	Excavation	653	CY	$19.03	$9,399.30	$0.00	$1,409.90	$1,621.38	$12,430.57	2	COMMENT
13	AOC 2 Soil Screening	Soil Screening	653	CY	$13.79	$5,805.41	$1,425.46	$603.54	$1,175.16	$9,009.56	1	COMMENT
15	AOC 2 Backfill	Backfill	849	CY	$48.78	$31,329.19	$0.00	$4,699.38	$5,404.29	$41,432.86	2	COMMENT
16	AOC 2 Survey	Survey	1	LS	$4,839.73	$4,024.72	$201.24	$10.06	$603.71	$4,839.73	4	COMMENT
17	AOC 2 Restoration	Restoration	1,802	SF	$0.12	$161.91	$0.00	$24.29	$27.93	$214.13	1	COMMENT
18	AOC 2 Transportation & Disposal	T&D	883	TON	$119.92	$80,106.06	$0.00	$12,015.91	$13,818.30	$105,940.27	1	COMMENT
19	AOC 3 Excavation	Excavation	3,802	CY	$11.89	$34,182.21	$0.00	$5,127.33	$5,896.43	$45,205.97	6	COMMENT
20	AOC 3 Soil Screening	Soil Screening	3,802	CY	$13.79	$33,779.81	$8,294.29	$3,511.79	$6,837.88	$52,423.78	5	COMMENT
22	AOC 3 Backfill	Backfill	1,794	CY	$41.46	$56,256.87	$0.00	$8,438.53	$9,704.31	$74,399.71	8	COMMENT
23	AOC 3 Survey	Survey	1	LS	$8,591.41	$7,144.62	$357.23	$17.86	$1,071.69	$8,591.41	13	COMMENT
24	AOC 3 Restoration	Restoration	11,485	SF	$0.12	$1,031.73	$0.00	$154.76	$177.97	$1,364.46	2	COMMENT
25	AOC 3 Transportation & Disposal	T&D	4,857	TON	$130.07	$477,741.88	$0.00	$71,661.28	$82,410.47	$631,813.64	3	COMMENT
26	AOC 4 Excavation	Excavation	373	CY	$19.03	$5,364.07	$0.00	$804.61	$925.30	$7,093.99	1	COMMENT
27	AOC 4 Soil Screening	Soil Screening	373	CY	$13.79	$3,313.08	$813.49	$344.43	$670.65	$5,141.65	1	COMMENT
29	AOC 4 Backfill	Backfill	485	CY	$48.78	$17,880.47	$0.00	$2,682.07	$3,084.38	$23,646.93	2	COMMENT
30	AOC 4 Survey	Survey	1	LS	$2,761.98	$2,296.86	$114.84	$5.74	$344.53	$2,761.98	3	COMMENT
31	AOC 4 Restoration	Restoration	873	SF	$0.12	$78.44	$0.00	$11.77	$13.53	$103.74	1	COMMENT
32	AOC 4 Transportation & Disposal	T&D	470	TON	$132.48	$47,051.58	$0.00	$7,057.74	$8,116.40	$62,225.72	1	COMMENT
33	AOC 5 Excavation	Excavation	1,441	CY	$11.89	$12,960.58	$0.00	$1,944.09	$2,235.70	$17,140.37	2	COMMENT
34	AOC 5 Soil Screening	Soil Screening	1,441	CY	$13.79	$12,808.01	$3,144.88	$1,331.54	$2,592.66	$19,877.08	2	COMMENT
36	AOC 5 Backfill	Backfill	1,874	CY	$39.04	$55,322.70	$0.00	$8,298.41	$9,543.17	$73,164.28	4	COMMENT
37	AOC 5 Survey	Survey	1	LS	$5,171.20	$4,300.37	$215.02	$10.75	$645.06	$5,171.20	6	COMMENT
38	AOC 5 Restoration	Restoration	1,425	SF	$1.27	$1,371.55	$0.00	$205.73	$236.59	$1,813.87	1	COMMENT
39	AOC 5 Transportation & Disposal	T&D	1,803	TON	$133.75	$182,376.73	$0.00	$27,356.51	$31,459.99	$241,193.23	2	COMMENT
40	AOC 6 Excavation	Excavation	3,358	CY	$11.89	$30,195.36	$0.00	$4,529.30	$5,208.70	$39,933.37	6	COMMENT
41	AOC 6 Soil Screening	Soil Screening	3,358	CY	$13.79	$29,839.89	$7,326.89	$3,102.19	$6,040.35	$46,309.32	6	COMMENT
43	AOC 6 Backfill	Backfill	4,366	CY	$39.04	$128,889.98	$0.00	$19,333.50	$22,233.52	$170,456.99	8	COMMENT
44	AOC 6 Survey	Survey	1	LS	$12,047.78	$10,018.94	$500.95	$25.05	$1,502.84	$12,047.78	14	COMMENT
45	AOC 6 Restoration	Restoration	8,228	SF	$0.12	$739.17	$0.00	$110.88	$127.51	$977.56	1	COMMENT
46	AOC 6 Transportation & Disposal	T&D	4,198	TON	$133.90	$425,035.55	$0.00	$63,755.33	$73,318.63	$562,109.51	3	COMMENT
47	AOC 7 Excavation	Excavation	8,902	CY	$9.06	$60,982.19	$0.00	$9,147.33	$10,519.43	$80,648.94	9	COMMENT
48	AOC 7 Soil Screening	Soil Screening	8,902	CY	$13.79	$79,095.15	$19,421.02	$8,222.83	$16,010.85	$122,749.86	9	COMMENT
50	AOC 7 Backfill	Backfill	5,786	CY	$39.04	$170,821.19	$0.00	$25,623.18	$29,466.65	$225,911.02	16	COMMENT
51	AOC 7 Survey	Survey	1	LS	$22,657.41	$18,841.92	$942.10	$47.10	$2,826.29	$22,657.41	25	COMMENT
52	AOC 7 Restoration	Restoration	23,220	SF	$0.33	$5,816.45	$0.00	$872.47	$1,003.34	$7,692.26	3	COMMENT
53	AOC 7 Transportation & Disposal	T&D	11,563	TON	$127.24	$1,112,490.15	$0.00	$166,873.52	$191,904.55	$1,471,268.22	12	COMMENT
54	AOC 8 Excavation	Excavation	221	CY	$19.03	$3,176.81	$0.00	$476.52	$548.00	$4,201.33	1	COMMENT
55	AOC 8 Soil Screening	Soil Screening	221	CY	$13.79	$1,962.13	$481.78	$203.99	$397.19	$3,045.09	1	COMMENT
57	AOC 8 Backfill	Backfill	287	CY	$48.70	$10,571.93	$0.00	$1,585.79	$1,823.66	$13,981.37	1	COMMENT
58	AOC 8 Survey	Survey	1	LS	$1,635.75	$1,360.29	$68.01	$3.40	$204.04	$1,635.75	2	COMMENT
59	AOC 8 Restoration	Restoration	393	SF	$0.12	$35.28	$0.00	$5.29	$6.09	$46.65	1	COMMENT
60	AOC 8 Transportation & Disposal	T&D	285	TON	$127.96	$27,594.00	$0.00	$4,139.10	$4,759.96	$36,493.06	1	COMMENT
61	AOC 9 Excavation	Excavation	202	CY	$19.03	$2,908.21	$0.00	$436.23	$501.67	$3,846.11	1	COMMENT
62	AOC 9 Soil Screening	Soil Screening	202	CY	$13.79	$1,796.23	$441.05	$186.74	$363.60	$2,787.62	1	COMMENT
64	AOC 9 Backfill	Backfill	263	CY	$48.70	$9,678.06	$0.00	$1,451.71	$1,669.47	$12,799.23	1	COMMENT
65	AOC 9 Survey	Survey	1	LS	$1,497.45	$1,245.28	$62.26	$3.11	$186.79	$1,497.45	2	COMMENT
66	AOC 9 Restoration	Restoration	393	SF	$0.12	$35.28	$0.00	$5.29	$6.09	$46.65	1	COMMENT

Table C-8
OABG Alternative 3 (Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs, and LTMgt) Cost Summary
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

ITEM No.	PAY ITEM DESCRIPTION	Work Item	QUANTITY	UNIT	UNIT PRICE	COST	PRIME G&A/OH	CONTRACTOR G&A/OH	FEE	TOTAL	ESTIMATED DURATION (DAYS)	COMMENTS
67	AOC 9 Transportation & Disposal	T&D	265	TON	$125.44	$25,116.29	$0.00	$3,767.44	$4,332.56	$33,216.29	1	COMMENT
68	AOC 10 Excavation	Excavation	181	CY	$19.03	$2,603.08	$0.00	$390.46	$449.03	$3,442.58	1	COMMENT
69	AOC 10 Soil Screening	Soil Screening	181	CY	$13.79	$1,607.77	$394.77	$167.15	$325.45	$2,495.15	1	COMMENT
71	AOC 10 Backfill	Backfill	235	CY	$48.70	$8,662.65	$0.00	$1,299.40	$1,494.31	$11,456.35	1	COMMENT
72	AOC 10 Survey	Survey	1	LS	$1,340.34	$1,114.62	$55.73	$2.79	$167.19	$1,340.34	2	COMMENT
73	AOC 10 Restoration	Restoration	393	SF	$0.12	$35.28	$0.00	$5.29	$6.09	$46.65	1	COMMENT
74	AOC 10 Transportation & Disposal	T&D	236	TON	$126.41	$22,531.60	$0.00	$3,379.74	$3,886.70	$29,798.04	1	COMMENT
75	AOC 11 Excavation	Excavation	182	CY	$19.03	$2,622.07	$0.00	$393.31	$452.31	$3,467.69	1	COMMENT
76	AOC 11 Soil Screening	Soil Screening	182	CY	$13.79	$1,619.50	$397.65	$168.37	$327.83	$2,513.35	1	COMMENT
77	Ex-Situ Treatment	Ex-Situ Soil Treatment	9,300	CY	$139.24	$979,170.21	$0.00	$146,875.53	$168,906.86	$1,294,952.60	62	COMMENT
78	AOC 11 Backfill	Backfill	237	CY	$48.70	$8,725.84	$0.00	$1,308.88	$1,505.21	$11,539.92	1	COMMENT
79	Riverbank, Western Ditch, and Site Restoration	Riverbank, Western Ditch, and Site Restoration	1	LS	$971,886.74	$734,886.00	$0.00	$110,232.90	$126,767.84	$971,886.74	20	COMMENT
80	AOC 11 Survey	Survey	1	LS	$1,350.11	$1,122.76	$56.14	$2.81	$168.41	$1,350.11	2	COMMENT
81	AOC 11 Restoration	Restoration	393	SF	$0.12	$35.28	$0.00	$5.29	$6.09	$46.65	1	COMMENT
82	AOC 11 Transportation & Disposal	T&D	237	TON	$127.07	$22,730.00	$0.00	$3,409.50	$3,920.93	$30,060.43	1	COMMENT
83	Western Drainage Ditch	Excavation (Soil)	50	CY	$19.03	$719.30	$0.00	$107.90	$124.08	$951.27	1	COMMENT
84	Western Drainage Ditch	Debris Removal	50	CY	$19.03	$719.30	$0.00	$107.90	$124.08	$951.27	1	COMMENT
85	Western Drainage Ditch T&D	T&D	138	TON	$117.07	$12,172.13	$0.00	$1,825.82	$2,099.69	$16,097.64	1	COMMENT
86	Western Drainage Ditch Restoration	Restoration	5,000	SF	$0.29	$1,078.00	$0.00	$161.70	$185.96	$1,425.66	1	COMMENT
87	OABG Surface Debris T&D	Debris Removal	215	TON	$53.40	$8,682.60	$0.00	$1,302.39	$1,497.75	$11,482.74	2	COMMENT
88	OABG Demobilization	Site Demobilization	1	LS	$42,342.19	$31,238.37	$1,132.21	$4,448.72	$5,522.89	$42,342.19	5	COMMENT
89	LUC Remedial Design	LUC Remedial Design	1	LS	$26,925.52	$13,096.39	$10,317.11	$0.00	$3,512.02	$26,925.52	10	COMMENT
90	Completion Report	Completion Report	1	LS	$30,214.66	$25,126.53	$1,256.33	$62.82	$3,768.98	$30,214.66	10	COMMENT
91	Explosive Safety Report	Explosive Safety Report	1	LS	$39,293.33	$32,676.36	$1,633.82	$81.69	$4,901.45	$39,293.33	10	COMMENT
92	Project Management	Project Management	1	LS	$621,763.34	$517,058.91	$25,852.95	$1,292.65	$77,558.84	$621,763.34	32	COMMENT

Table C-9
Ex Situ Thermal Cost
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Escalation rate	1.355	12 based on the Turner Building Cost Index)				
Output	15	tons/hr	(Focus, ave)			
Total Treatment volume	9300	cy	13950	tons		
Duration	620	hrs	62	days		
	RS Means (2002)	Cost (2002)	Units	Escalated Cost (Q4 2012)	Units	Extended Costs ($)
Permitting/Engineering	33 14 0203	$39,201.00	ea	$53,133.50	1	$53,134
LTTD, fixed costs (mob/demob, engineering)	33 14 0221	$108,214.00	ea	$146,674.55	1	$146,675
8" structural slab on grade	18 02 0322	$6.75	/sf	$9.15	5000	$45,745
Pretreatment System Operation (Labor)	33 13 1120	$209.00	/day	$283.28	62	$17,563
LTTD, low moisture, VOC soil (10-50K tons)	33 14 0233	$32.46	/ton	$44.00	13950	$613,754
Oversight	CH2M	-	/day	$1,150.00	62	$71,300
Per Diem/car rental/fuel/consumables	est	-	/day	$500.00	62	$31,000
Total						$979,170
					Price Per CY	$105.29
					Price Per TON	$70.19

Table C-10
OABG Long-Term Management
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Alternative:	Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs, and LTMgt				COST ESTIMATE SUMMARY	
LTMgt COSTS (Yearly Inspections)						
	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
	Project Engineer	16	HR	$81.10	$1,298	
	Project Engineer	16	HR	$81.10	$1,298	
	Yearly Repair Allowance	1	LS	$2,500.00	$2,500	
	Travel Allowance	4	DAY	$250.00	$1,000	
	TOTAL				$6,095	
LTMgt COSTS (5 Year Reports)						
	DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
	Project Engineer	120	HR	$81.10	$9,732	
	Word Processing	40	HR	$35.27	$1,411	
	TOTAL				$11,143	
30-YEAR COST CALCULATION						
ESCALATION FACTOR	2.5%					
COST TYPE	YEAR	TOTAL COST	ESCALATION COST	REPORT COST	TOTAL COST	NOTES
YEARLY INSPECTION	1	$6,095.26	152.38	$0.00	$6,247.64	
YEARLY INSPECTION	2	$6,247.64	156.19	$0.00	$6,403.83	
YEARLY INSPECTION	3	$6,403.83	160.10	$0.00	$6,563.93	
YEARLY INSPECTION	4	$6,563.93	164.10	$0.00	$6,728.03	
YEARLY INSPECTION	5	$6,728.03	168.20	$11,143.21	$18,039.44	
YEARLY INSPECTION	6	$6,896.23	172.41	$0.00	$7,068.63	
YEARLY INSPECTION	7	$7,068.63	176.72	$0.00	$7,245.35	
YEARLY INSPECTION	8	$7,245.35	181.13	$0.00	$7,426.48	
YEARLY INSPECTION	9	$7,426.48	185.66	$0.00	$7,612.14	
YEARLY INSPECTION	10	$7,612.14	190.30	$11,143.21	$18,945.66	
YEARLY INSPECTION	11	$7,802.45	195.06	$0.00	$7,997.51	
YEARLY INSPECTION	12	$7,997.51	199.94	$0.00	$8,197.45	
YEARLY INSPECTION	13	$8,197.45	204.94	$0.00	$8,402.38	
YEARLY INSPECTION	14	$8,402.38	210.06	$0.00	$8,612.44	
YEARLY INSPECTION	15	$8,612.44	215.31	$11,143.21	$19,970.97	
YEARLY INSPECTION	16	$8,827.75	220.69	$0.00	$9,048.45	
YEARLY INSPECTION	17	$9,048.45	226.21	$0.00	$9,274.66	
YEARLY INSPECTION	18	$9,274.66	231.87	$0.00	$9,506.53	
YEARLY INSPECTION	19	$9,506.53	237.66	$0.00	$9,744.19	

Table C-10
OABG Long-Term Management
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

COST TYPE	YEAR	TOTAL COST	ESCALATION COST	REPORT COST	TOTAL COST	NOTES
YEARLY INSPECTION	20	$9,744.19	243.60	$11,143.21	$21,131.01	
YEARLY INSPECTION	21	$9,987.79	249.69	$0.00	$10,237.49	
YEARLY INSPECTION	22	$10,237.49	255.94	$0.00	$10,493.43	
YEARLY INSPECTION	23	$10,493.43	262.34	$0.00	$10,755.76	
YEARLY INSPECTION	24	$10,755.76	268.89	$0.00	$11,024.66	
YEARLY INSPECTION	25	$11,024.66	275.62	$11,143.21	$22,443.49	
YEARLY INSPECTION	26	$11,300.27	282.51	$0.00	$11,582.78	
YEARLY INSPECTION	27	$11,582.78	289.57	$0.00	$11,872.35	
YEARLY INSPECTION	28	$11,872.35	296.81	$0.00	$12,169.16	
YEARLY INSPECTION	29	$12,169.16	304.23	$0.00	$12,473.39	
YEARLY INSPECTION	30	$12,473.39	311.83	$11,143.21	$23,928.43	
TOTAL COST					$341,148	

Table C-11
OABG Present Worth
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

PRESENT WORTH CALCULATION Long Term Management					
Discount Rate:	3.0%				
Year	Real Cost Incurred	Cost Description	Cost Type	Discount Factor	Present Worth
0	$0	LTMgt COSTS (Yearly Inspections)	O&M	1.00	$0
1	$6,248	LTMgt COSTS (Yearly Inspections)	O&M	1.03	$6,066
2	$6,404	LTMgt COSTS (Yearly Inspections)	O&M	1.06	$6,036
3	$6,564	LTMgt COSTS (Yearly Inspections)	O&M	1.09	$6,007
4	$6,728	LTMgt COSTS (Yearly Inspections)	O&M	1.13	$5,978
5	$18,039	LTMgt COSTS (Yearly Inspections)	O&M	1.16	$15,561
6	$7,069	LTMgt COSTS (Yearly Inspections)	O&M	1.19	$5,920
7	$7,245	LTMgt COSTS (Yearly Inspections)	O&M	1.23	$5,891
8	$7,426	LTMgt COSTS (Yearly Inspections)	O&M	1.27	$5,863
9	$7,612	LTMgt COSTS (Yearly Inspections)	O&M	1.30	$5,834
10	$18,946	LTMgt COSTS (Yearly Inspections)	O&M	1.34	$14,097
11	$7,998	LTMgt COSTS (Yearly Inspections)	O&M	1.38	$5,778
12	$8,197	LTMgt COSTS (Yearly Inspections)	O&M	1.43	$5,750
13	$8,402	LTMgt COSTS (Yearly Inspections)	O&M	1.47	$5,722
14	$8,612	LTMgt COSTS (Yearly Inspections)	O&M	1.51	$5,694
15	$19,971	LTMgt COSTS (Yearly Inspections)	O&M	1.56	$12,819
16	$9,048	LTMgt COSTS (Yearly Inspections)	O&M	1.60	$5,639
17	$9,275	LTMgt COSTS (Yearly Inspections)	O&M	1.65	$5,611
18	$9,507	LTMgt COSTS (Yearly Inspections)	O&M	1.70	$5,584
19	$9,744	LTMgt COSTS (Yearly Inspections)	O&M	1.75	$5,557
20	$21,131	LTMgt COSTS (Yearly Inspections)	O&M	1.81	$11,700
21	$10,237	LTMgt COSTS (Yearly Inspections)	O&M	1.86	$5,503
22	$10,493	LTMgt COSTS (Yearly Inspections)	O&M	1.92	$5,476
23	$10,756	LTMgt COSTS (Yearly Inspections)	O&M	1.97	$5,450
24	$11,025	LTMgt COSTS (Yearly Inspections)	O&M	2.03	$5,423
25	$22,443	LTMgt COSTS (Yearly Inspections)	O&M	2.09	$10,719
26	$11,583	LTMgt COSTS (Yearly Inspections)	O&M	2.16	$5,371
27	$11,872	LTMgt COSTS (Yearly Inspections)	O&M	2.22	$5,345
28	$12,169	LTMgt COSTS (Yearly Inspections)	O&M	2.29	$5,319
29	$12,473	LTMgt COSTS (Yearly Inspections)	O&M	2.36	$5,293
30	$23,928	LTMgt COSTS (Yearly Inspections)	O&M	2.43	$9,858
LIFETIME O&M	$147,753		Total Present Worth O&M		$210,862

Table C-12
DBA Wages
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

DBA WAGES: General Decision Number: WV130053 02/15/2013 WV53

POSITION	HOURLY RATE	FRINGE	TAX/WC	STRAIGHT TIME RATE	OVERTIME RATE	50 HR RATE	60 HR RATE
Cement Mason/Concrete Finisher	$29.52	$14.16	$10.92	$54.60	$81.90	$60.06	$63.70
Electrician	$29.40	$14.97	$11.09	$55.46	$83.19	$61.01	$64.71
Ironworker-Ornamental	$34.29	$16.49	$12.70	$63.48	$95.21	$69.82	$74.05
Ironworker-Reinforcement	$31.56	$14.70	$11.57	$57.83	$86.74	$63.61	$67.46
Laborer-Group 1-Tunnel	$26.15	$14.10	$10.06	$50.31	$75.47	$55.34	$58.70
Laborer-Group 2-Tools/Concrete/Grade	$25.12	$14.10	$9.81	$49.03	$73.54	$53.93	$57.20
Laborer-Group 3-Carpenter/Common/Flagger	$7.25	$0.00	$1.81	$9.06	$13.59	$9.97	$10.57
Laborer-Mason	$25.12	$14.10	$9.81	$49.03	$73.54	$53.93	$57.20
Laborer-Pipeline	$24.06	$14.10	$9.54	$47.70	$71.55	$52.47	$55.65
Millwright	$26.55	$13.35	$9.98	$49.88	$74.81	$54.86	$58.19
Operator- Group 1: Crane/Loader (6 CY)	$31.75	$16.85	$12.15	$60.75	$91.13	$66.83	$70.88
Operator- Group 2: Loader (Up To 6 CY)	$28.99	$16.85	$11.46	$57.30	$85.95	$63.03	$66.85
Operator- Group 3: Roller	$27.88	$16.85	$11.18	$55.91	$83.87	$61.50	$65.23
Operator- Group 4: Other	$24.42	$16.85	$10.32	$51.59	$77.38	$56.75	$60.19
Operator- Pipeline-Group 1	$34.62	$16.72	$12.84	$64.18	$96.26	$70.59	$74.87
Operator- Pipeline-Group 2	$21.29	$12.42	$8.43	$42.14	$63.21	$46.35	$49.16
Truck Driver-Single/Double Ax	$28.99	$16.85	$11.46	$57.30	$85.95	$63.03	$66.85

Appendix D
SiteWise Sustainability Evaluation

APPENDIX D
SiteWise Sustainability Evaluation

D.1 Introduction

This appendix presents the approach taken and results obtained from a sustainability analysis performed for Site 1 at the Allegany Ballistics Laboratory (ABL), in Rocket Center, West Virginia. A description and history of Site 1 is provided in the Feasibility Study (FS). Remedial alternatives were developed to address potential sources of contamination in soil at Site 1 in two treatment areas, the Active Burning Ground (ABG) and Outside Active Burning Ground (OABG). A detailed summary of the remedial alternatives is provided in the FS.

The following remedial alternatives were identified for the ABG soil:

- Alternative 1 - No Action
- Alternative 2 –Excavation of Areas of Concern (AOCs), Offsite Disposal, Land Use Controls (LUCs), and LTMgt

The following Remedial alternatives were identified for the OABG soil:

- Alternative 1 - No Action
- Alternative 2 – Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
- Alternative 3 – Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, LUCs, and LTMgt

The purpose of this analysis is to provide a quantitative assessment of the potential environmental and social impact of each removal action. The sustainability analysis was performed using SiteWise Version 2.0 (Battelle, 2011) for ABG Alternative 2 and OABG Alternatives 2 and 3. Although the No Action alternative (Alternative 1) has no actions that would impact sustainability, it is not considered a viable alternative and will not be further discussed in this analysis.

D.2 Method and Assumptions

The SiteWise tool consists of a series of Excel-based spreadsheets used to conduct a baseline assessment of sustainability metrics. The assessment is carried out using a spreadsheet-based building block approach, where every remedial alternative is first broken down into modules that mirror the phases of remedial action work, specifically: remedial investigation (RI), remedial action construction (RAC), remedial action operation (RAO), and long-term management (LTMgt). For this analysis only the RAC and LTMgt phases were applicable.

SiteWise uses various emission factors from governmental or non-governmental research sources to determine the environmental impact of each activity. The quantitative metrics calculated by the tool include:

1) Greenhouse gases (GHGs) reported as metric tons of carbon dioxide equivalents (CO_2e), consisting of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)

2) Energy usage (expressed as millions of British Thermal Units [MMBTU])

3) Water usage (gallons of water)

4) Air emissions of criteria pollutants consisting of metric tons of nitrogen (NO_x), sulfur oxides (SO_x), and particulate matter (PM_{10})

5) Accident risk (risk of injury and risk of fatality)

For the purpose of this discussion the term footprint will be used to describe the quantified emissions or quantities for each metric. To estimate the sustainability footprint for each remedial alternative, only those elements possessing important sustainability elements were included in the assessment. The first four metrics are collectively referred to as the environmental footprint. The footprints of each remedial phase are combined into overall footprints for each remedial action. The fifth metric is considered a social metric. Like the environmental metrics, the social metrics associated with each project phase is combined into an overall accident risk metric for the project.

A lower footprint indicates lower deleterious impacts to environmental and social metrics, which collectively make up the SiteWise sustainability metrics. Conversely, a higher footprint indicates higher deleterious impacts associated with the SiteWise metrics. The major conclusions of this sustainability analysis are incorporated into the short-term effectiveness criteria evaluation of the FS.

The following is a description of the major activities for each alternative covered under each remedial action phase.

ABG Soil Alternatives:

- RAC: Transportation of personnel (road) and equipment for construction efforts including construction of an access road, soil excavating and backfilling, water use for dust suppression during excavation activities, establishing LUCs, and onsite labor.
  - Alternative 2 involves excavation of Subareas 1 through 6 within the ABG as determined by the 95% upper control limit (UCL) industrial scenario (total of 1,310 cubic yards) using bulldozers and excavators, backfill to original grade, and transportation of waste to a non-hazardous landfill.
- LTMgt: Involves transportation and onsite labor hours for two people to perform annual LUCs inspections for 30 years.

OABG Soil Alternatives:

- RAC: Transportation of personnel (road) and equipment for construction efforts involving construction an access road, soil excavating and backfilling, water use for dust suppression during excavation activities, establishing LUCs, and onsite labor.
  - Alternative 2 involves removal of surficial debris, excavation of Subareas 1 through 11 within the OABG as determined by the 95% UCL industrial scenario (approximately 17,000 cubic yards), anomaly avoidance, debris handling and management, and offsite disposal of hazardous and non-hazardous waste.
  - Alternative 3 is comprised of the same components as Alternative 2, with an additional component of *ex situ* treatment of waste soil deemed hazardous using a portable low temperature thermal desorption (LTTD) to levels deemed non-hazardous prior to offsite disposal.
- LTMgt: All alternatives involve transportation and onsite labor hours for two people to perform annual LUCs inspections for 30 years.

D.2.1 General Assumptions

The specific assumptions made for the individual remedies are presented in **Tables D-1** through **D-3**. The following overall assumptions are used for the SiteWise tool evaluation:

- The complete environmental footprint for production of equipment used, or production of the vehicles used for transportation, is not considered in this analysis.
- Daily local transportation is assumed to consist of 25 miles of driving a light duty truck per day.
- Local transportation is assumed to be shared (2 people per vehicle as specified in **Table D-1** through **D-3**).
- Soil is assumed to weigh 1.5 tons per cubic yard
- Gravel is assumed to weigh 1.4 tons per cubic yard
- Resources such as gravel and soil are delivered from a source 40 miles away
- Non-hazardous waste landfill is 25 miles away, hazardous waste landfill is 350 miles away
- The following weights and distance for delivery are used for equipment:

- Bulldozer – 10 tons, 120 miles round trip
- Excavator – 30 tons, 120 miles round trip
- Loader – 13 tons, 120 miles round trip
- Roller – 5 tons, 120 miles round trip
- Portable LTTD – 30 tons, 1600 miles round trip
- Power Screen– 15 tons, 120 miles round trip

D.3 Results

ABG Soil Alternative

Since only one alternative was analyzed for the ABG area, a comparative analysis was not completed. The overall footprint for the ABG soil alternative is provided in the following paragraph. SiteWise is typically used as a comparison tool, however, in this case, it can be used to identify opportunities to reduce impacts by optimizing areas that have larger footprints, where possible.

The RAC Phase contributed significantly more to Alternative 2's overall footprint as opposed to the LUC Phase due to the extent of construction activities involved. Within the RAC phase, the production of the backfill and gravel (borrow pit and quarry operations) accounted for over half of the GHG and total energy footprints. The transportation of the equipment and materials, primarily backfill and gravel, and handling of the residual waste also contributed to the overall GHG and total energy footprints, approximately one quarter each. Waste transportation and handling comprised the majority of the NO_x, SO_x, and PM_{10} footprints. The onsite labor hours during construction activities contributed to the majority of the accident injury risks. Transportation (waste, equipment and backfill, and personnel) and onsite labor hours contributed evenly to the accident risk fatality risks. Results are provided in **Table D-4** and **Figure D-1**.

OABG Soil Alternatives

It should be noted that while this analysis compares the environmental footprints of each of the alternatives, the alternatives provide different end-uses. Therefore, a comparison of the results of the alternatives needs to be made in the context of the benefits (e.g., ARAR compliance, contaminant reduction, cost effectiveness, and etc.) of each of the alternatives.

The overall quantitative footprints for each alternative are provided with the relative impact of each alternative in each footprint (**Table D-5**). The relative impact is a qualitative assessment of the relative footprint of each alternative, a rating of high, medium, or low is assigned to each alternative based on its performance against the other alternatives. The tool assigns a rating of high to the highest footprint in each category and assigns the rankings of other alternatives based on the difference in the data between alternatives. The ranking is based on a 30 percent difference, for example, if the footprints of two alternatives are within 30 percent of each other they will be given the same rating. This allows for some uncertainty inherent in the assumptions used in the model.

The comparative analysis for Alternatives 2 and 3 is summarized in **Figure D-2**. **Table D-5** presents a comparison of the quantitative environmental footprint metrics evaluated for each of the remedial alternatives. Alternative 3 has the highest GHG emissions, total energy used, water use, and NO_x emissions footprints because this alternative is comprised of similar components to Alternative 2, with an additional component of LTTD ex *situ* treatment of waste soil. The difference is primarily due to the increased fuel consumption and water requirements with the LTTD treatment. The PM_{10} and SO_x footprints are comparable for Alternatives 2 and 3. Alternative 2 has the highest accident fatality and risk footprints primarily due to the transportation of hazardous waste included in this alternative. The footprints for each alternative are discussed below.

- Alternative 2— Removal of Surface Debris, Excavation of AOCs, Offsite Disposal and LUCs
  Residual handling accounted for approximately half of the GHG and total energy footprints and the majority of NO_x, SO_x, PM_{10}, and accident risk footprints. Activities associated with residual handling were transportation to the hazardous waste landfill and equipment use at the hazardous and non hazardous waste landfills to treat and/or emplace the waste. The extraction of soil used for backfill and gravel used for the temporary access road also contributed approximately one third of the total GHG and almost half of the total

energy footprints. Water use can be attributed to dust suppression. Results are provided in **Table D-6** and **Figure D-3**.

- Alternative 3 – Removal of Surface Debris, Excavation of AOCs, *Ex Situ* Treatment, Offsite Disposal, and LUCs During the RAC phase, fuel used to power the portable LTTD accounted for the majority of the GHG, total energy and NO_X footprints. Waste handling accounted for the majority of the PM_{10} and SO_X footprints. Accident risks of fatality were driven by onsite labor hours and equipment and material transportation with lesser contributions from waste and personnel transportation. Accident risks injury were primarily driven by onsite labor hours although equipment, material, personnel, and waste transportation also contributed. Water use is attributed to dust suppression and the LTTD treatment. Results are provided in **Table D-7** and **Figure D-4**.

D.4 Uncertainty Assessment

The SiteWise™ tool calculates environmental and risk footprints based on industry averages, published emissions factors, and generalized data sources. The footprint results are not representative of actual emissions and should be used for comparative purposes only.

Only GHG and total energy use data is available in the SiteWise inventory for material production. Other footprints such as water use and criteria air pollutants are likely underrepresented in the SiteWise analysis.

Operating conditions for the LTTD system are highly dependent on waste feed throughput, heat content of the waste feed, moisture content, and other physical and chemical properties of the waste being treated. Fuel usage was estimated based on similar projects; however, actual operating conditions may be different.

D.5 Recommendations

The estimates from the SiteWise™ tool were used to estimate the environmental footprint of the alternatives. Once the alternative is selected, it is recommended that the footprint of the selected alternative be further evaluated in the design phase of the projects to explore opportunities to optimize the environmental footprint of the project and integrate sustainable remediation best practices in the design, construction, and operation of the alternative.

D.6 References

Battelle. 2011. *SiteWise Version 2 User Guide*. NAVFAC Engineering Service Center, UG-2092-ENV. June.

Table D-1
ABG Alternative 2 -Excavation of AOCs, Offsite Disposal, LUCs and LTMgt
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Sitewise Tab	Assumptions
Remedial Action Construction	Excavation of AOCs, Offsite Disposal
Material Production	Gravel for access road - 556 SY 6 inches deep, 278 CY, 1.4 tons/cy = 778,400 pounds
	Backfill - 2000 CY x 1.5 tons/cy = 6,000,000 lbs
Personnel Transportation - Road	Mobilization/Demobilization to Site (light truck, gasoline powered) Operators/Laborers - 2 people/vehicle, 3 vehicles, 25 miles,28 days (84 trips)
	Surveyor - 2 people/vehicle, 1 vehicle, 25 miles/trip R/T, 28 trips
	Project Engineer - 1 person, 25 miles, 28 days (28 trips)
Equipment Transportation - Road	Assume Diesel
	Two excavators - 30 tons each,120 miles R/T
	Loader - 13 tons, 120 miles R/T
	Dozer - 10 tons, 120 miles R/T
	Roller - 5 tons, 120 miles R/T
	Backfill - 101 CY (sub area 1), 301 CY (sub area 2), 400 CY (sub area 3), 400 CY (sub area 4), 400 CY (sub area 5), 400 CY (sub area 6) = 2000 CYs, 1.5 tons/CY, 3000 tons, 20 tons/ trip, 150 trips, 40 miles full, 40 miles empty, 6000 miles each way
	Gravel for access road - 556 SY 6 inches deep, 278 CY, 1.4 tons/CY, 390 tons, 40 miles, 20 trips full/empty, 800 miles each way
Equipment Use	Excavator - 80 CY (sub area 1), 230 CY (sub area 2), 306 CY (sub area 3), 306 CY (sub area 4), 306 CY (sub area 5), 306 CY (sub area 6) = 1534 total CY
	Loader - 80 CY (sub area 1), 230 CY (sub area 2), 306 CY (sub area 3), 306 CY (sub area 4), 306 CY (sub area 5), 306 CY (sub area 6) = 1534 total CY
	Dozer - 278 CY (access road), 100 CY (sub area 1), 300 CY (sub area 2), 400 CY (sub area 3), 400 CY (sub area 4), 400 CY (sub area 5), 400 CY (sub area 6) = 2278 total CY
	Roller - 7,070 square feet, 15 work days
Transportation and Disposal	1,310 CY, 1.5 tons/CY, 1, 965tons, 20 tons/trip, 98 trips full/empty, 25 miles each way, non-haz
Water Use	4,000 gallons per day, 112,000 gallons
Labor Hours Onsite - Construction Labor	2240 hours (8 people, 10 hours/day, 28 days)
Longterm Monitoring	LUCs
Personnel Transportation - Roads	Mobilization/Demobilization to Site (light duty truck, gasoline powered) 1 events per year for 30 years, 50 miles R/T, 2 people per vehicle, 2 people required per event = 30 total trips all other travel assumed to be local and negligible
Labor Hours Onsite - Operating Engineers	600 hours (1 day/year, 10 hours per day, 2 people per vehicle)

Notes:

R/T = round trip

CY = cubic yards

TABLE D-2
OABG Alternative 2 - Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Sitewise Tab	Assumptions
Remedial Action Construction	Removal of Surface Debris, Excavation of AOCs, Offsite Disposal
Material Production	Backfill - 21960 CY x 1.5 tons/cy = 65,880,000 lbs
	Gravel for access road - 556 SY 6 inches deep, 278 CY, 1.4 tons/cy = 778,400 pounds
Personnel Transportation - Road	Mobilization/Demobilization to Site (light truck, gasoline powered) Operators/Laborers - 2 people/vehicle, 4 vehicles, 25 miles, 126 days (504 trips)
	Surveyor - 2 people/vehicle, 1 vehicle, 25 miles/trip R/T, 126 trips
	Project Engineer - 1 person, 25 miles, 126 days
Equipment Transportation - Road	Assume Diesel
	Excavator - 30 tons, 120 miles R/T
	2 Loaders - 13 tons each, 120 miles R/T
	Dozer - 10 tons, 120 miles R/T
	Roller - 5 tons, 120 miles R/T
	Power screen - 15 tons, 120 miles R/T
	Backfill - 242 CY (area 1),502 CY (area 2), 4395 CY (area 3), 466 CY (area 4), 1866 CY (area 5), 4366 CY (area 6) , 9306 CY (Area 7), 239 CY (area 8), 200 CY (area 9), 186 CY (area 10), 192 CY (area 11) = 21960 CY, 1.5 tons/CY, 32940 tons, 20 tons/trip, 40 miles, 1647 trips full/empty, 65,880 total miles each way
	Gravel for access road - 556 SY 6 inches deep, 278 CY, 1.4 tons/CY, 390 tons, 40 miles, 20 trips full/empty, 800 total miles
Equipment Use	Excavator - 186 CY (area 1), 386 CY (area 2), 3380 CY (area 3), 359 CY (sub area 4), 1435 CY (area 5), 3358 CY (area 6) , 184 CY (area 8), 153 CY (area 9), 142 CY (area 10), 147 CY (area 11) = 9,730 CY
	Loader - 186 CY + 232 CY (area 1), 386 CY + 386 CY(area 2), 3380 CY +3380 CY (area 3), 359 CY +359 CY (area 4), 1435 CY +1435 (area 5), 3358 CY + 3358 CY (area 6) , 7158 CY + 7158 CY (area 7), 184 CY + 184 CY (area 8), 153 CY + 153 CY (area 9), 142 CY +142 CY (area 10), 147 CY + 147 CY (area 11) = 33,822 CY
	Dozer - 278 CY (access road), 242 CY (area 1), 502 CY (area 2), 4395 CY (area 3), 456 CY (area 4), 1866 CY (area 5), 4365 CY (area 6), 7158 CY + 9306 CY (area 7), 239 CY (area 8), 200 CY (area 9), 186 CY (area 10), 192 CY (area 11) = 29,385 CY
	Roller - 41,271 square feet, 15 working days
	Power Screen - Assume approx 17,172 CY soil screened, 100 CY/hr = approximately 170 hours Assume diesel powered internal combustion engine w/efficiency of 10 gallons per hour operating for 170 hours
Transportation and Disposal	Hazardous soil : 9,375 CY , 1.5 tons/CY , 14,062 tons total, 20 tons/trip. 703 trips 350 miles full/empty
	Non-Hazardous Soil: 7,797 CY, 1.5 tons/CY, 11,695 tons total, 20 tons/trip, 585 trips 25 miles full/empty
Water Use	4,000 gallons/day for 126 days = 504,000 gallons
Labor Hours Onsite - Construction Labor	10,080 hours (8 people, 10 hours/day, 126 days)
Longterm Monitoring	LUCs
Personnel Transportation - Roads	Mobilization/Demobilization to Site (light duty truck, gasoline powered) 1 events per year for 30 years, 50 miles R/T, 2 people per vehicle, 2 people required per event = 30 total trips all other travel assumed to be local and negligible
Labor Hours Onsite - Operating Engineers	600 hours (1 day/year, 10 hours per day, 2 people per vehicle)

Notes:
R/T = round trip
SY = square yards
CY = cubic yards

TABLE D-3

OABG Alternative 3 - Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs, and LTMgt

Site 1 (OU-4) Soil Feasibility Study

Allegany Ballistics Laboratory, Rocket Center, WV

Sitewise Tab	Assumptions
Remedial Action Construction	Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal
Material Production	Backfill - 21960 CY x 1.5 tons/cy = 65,880,000 lbs
	Gravel for access road - 556 SY 6 inches deep, 278 CY, 1.4 tons/cy = 778,400 pounds
Personnel Transportation - Road	Mobilization/Demobilization to Site (light truck, gasoline powered) Operators/Laborers - 2 people/vehicle, 4 vehicles, 25 miles, 168 days (672 trips)
	Surveyor - 2 people/vehicle, 1 vehicle, 25 miles/trip R/T, 168 trips
	Project Engineer - 1 person, 25 miles, 168 days
Equipment Transportation - Road	Assume Diesel
	Excavator - 30 tons, 120 miles R/T
	2 Loaders - 13 tons each, 120 miles R/T
	Dozer - 10 tons, 120 miles R/T
	Roller - 5 tons, 120 miles R/T
	Portable LTTD - 30 tons , 1600 miles R/T (from Missouri)
	Power screen - 15 tons, 120 miles R/T
	Backfill - 242 CY (area 1),502 CY (area 2), 4395 CY (area 3), 466 CY (area 4), 1866 CY (area 5), 4366 CY (area 6) , 9306 CY (Area 7), 239 CY (area 8), 200 CY (area 9), 186 CY (area 10), 192 CY (area 11) = 21960 CY, 1.5 tons/CY, 32940 tons, 20 tons/trip, 40 miles, 1647 trips full/empty, 65,880 total miles each way
	Gravel for access road - 556 SY 6 inches deep, 278 CY, 1.4 tons/CY, 390 tons, 40 miles, 20 trips full/empty, 800 miles total
Equipment Use	Excavator - 186 CY (area 1), 386 CY (area 2), 3380 CY (area 3), 359 CY (sub area 4), 1435 CY (area 5), 3358 CY (area 6) , 184 CY (area 8), 153 CY (area 9), 142 CY (area 10), 147 CY (area 11) = 9,730 CY
	Loader - 186 CY + 232 CY +232 (area 1), 386 CY + 386 CY + 386 CY (area 2), 3380 CY +3380 CY +3380 (area 3), 359 CY +359 CY +359 CY (area 4), 1435 CY +1435 +1435 (area 5), 3358 CY + 3358 CY +3358 (area 6) , 7158 CY + 7158 CY +7158 (area 7), 184 CY + 184 CY +184 (area 8), 153 CY + 153 CY +153 (area 9), 142 CY +142 CY +142(area 10), 147 CY + 147 CY +147 (area 11) = 50,756 CY
	Dozer - 278 CY (access road), 242 CY (area 1), 502 CY (area 2), 4395 CY (area 3), 456 CY (area 4), 1866 CY (area 5), 4365 CY (area 6), 7158 CY + 9306 CY (area 7), 239 CY (area 8), 200 CY (area 9), 186 CY (area 10), 192 CY (area 11) = 29,385 CY
	Roller - 41,271 square feet, 15 working days
	Power Screen - Assume approx 17,172 CY soil screened, 100 CY/hr = approximately 170 hours Assume diesel powered internal combustion engine w/efficiency of 10 gallons per hour operating for 170 hours
	LTTD: Electric Use - 1.5 kWh/ton, 14,062 tons = 21,093 kWh
	Fuel Use - 2000 cf/ton, 14,062 tons = 28,124,000 cf natural gas
Transportation and Disposal	Non-Hazardous Soil: 17,172 CY , 1.5 tons/CY, 25,758 tons total, 20 tons/trip. 1,288 trips 25 miles full/empty
Water Use	Dust Suppression - 4,000 gallons/day for 168 days, 672,000 gallons
	LTTD: 50 gallons of water per ton, 22,324 tons , 1,116,200 gallons
Labor Hours Onsite - Construction Labor	13440 hours (8 people, 10 hours/day, 168 days)
Longterm Monitoring	LUCs
Personnel Transportation - Roads	Mobilization/Demobilization to Site (light duty truck, gasoline powered) 1 events per year for 30 years, 50 miles R/T, 2 people per vehicle, 2 people required per event = 30 total trips all other travel assumed to be local and negligible
Labor Hours Onsite - Operating Engineers	600 hours (1 day/year, 10 hours per day, 2 people per vehicle)

Notes:

R/T = round trip

TABLE D-4
ABG Alternative 2 - Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Phase	Activities	GHG Emissions	Total Energy Used	Water Used	NO_x Emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Remedial Action Construction	Consumables	6.86E+01	1.26E+03	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	1.93E+00	2.43E+01	NA	8.0E-04	2.5E-05	1.1E-04	5.5E-05	4.4E-03
	Transportation-Equipment	2.39E+01	3.13E+02	NA	7.5E-03	1.3E-04	6.7E-04	1.1E-04	8.9E-03
	Equipment Use and Misc	1.72E+00	3.04E+01	1.1E+05	1.0E-02	2.5E-03	1.1E-03	2.1E-04	5.3E-02
	Residual Handling	3.05E+01	5.78E+02	NA	1.3E-01	6.7E-02	3.6E-01	3.8E-05	3.1E-03
	Sub-Total	1.27E+02	2.21E+03	1.12E+05	1.46E-01	6.95E-02	3.59E-01	4.13E-04	6.91E-02
Longterm Monitoring	Consumables	0.00E+00	0.00E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	5.72E-01	7.19E+00	NA	2.1E-04	7.5E-06	4.3E-05	2.3E-05	1.9E-03
	Transportation-Equipment	0.00E+00	0.00E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-05	1.4E-02
	Residual Handling	0.00E+00	0.00E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	5.72E-01	7.19E+00	0.00E+00	2.12E-04	7.45E-06	4.29E-05	5.55E-05	1.57E-02
Total		1.27E+02	2.21E+03	1.12E+05	1.46E-01	6.95E-02	3.59E-01	4.69E-04	8.47E-02

Notes:
MMBTU - million British Thermal Unit
NOx - Nitrogen Oxides
SOx - Sulfur Oxides
PM10 - Particulate Matter
NA - Not Applicable
GHG - Greenhouse Gases

TABLE D-5
Relative Impact of OABG Alternatives
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

Remedial Alternatives	GHG Emissions	Total energy Used	Water Used	NO_x emissions	SO_x Emissions	PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
	metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Alternative 1- No Action	0	0	0	0	0	0	0	0
Alternative 2 -Removal of Surface Debris, Excavation of AOCs, Offsite Disposal and LUCs, and LTMgt	2.15E+03	3.19E+04	5.04E+05	2.35E+00	9.60E-01	4.98E+00	6.38E-03	6.85E-01
Alternative 3 - Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs , and LTMgt	3.67E+03	5.20E+04	1.80E+06	3.52E+01	1.01E+00	4.86E+00	3.23E-03	4.85E-01

Remedial Alternatives	GHG Emissions	Total energy Used	Water Used[1]	NO_x emissions	SO_x Emissions	PM10 Emissions	Accident Risk Fatality	Accident Risk Injury
Alternative 1- No Action	Low	Low	Low	Low	Low	Low	Low	Low
Alternative 2 -Removal of Surface Debris, Excavation of AOCs, Offsite Disposal and LUCs, and LTMgt	Medium	Medium	Low	Low	High	High	High	High
Alternative 3 - Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs , and LTMgt	High	High	High	High	High	High	Medium	High

The relative impact is a qualitative assessment of the relative footprint of each alternative, a rating of High for an alternative is assigned if it is at least 70 percent of the maximum footprint, a rating of Medium is assigned if it is between 30 and 70 percent of the maximum footprint, and a rating of Low is assigned if it is less than 30 percent of the maximum footprint.

Notes:

(1) Water Use is a qualitative assessment

MMBTU - million British Thermal Unit

NOx - Nitrogen Oxides

SOx - Sulfur Oxides

LUCs - land use controls

PM10 - Particulate Matter

GHG - Greenhouse Gases

MEC - munitions and explosives of concern

TABLE D-6
OABG Alternative 2 - Removal of Surface Debris, Excavation of AOCs, Offsite Disposal, LUCs, and LTMgt
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

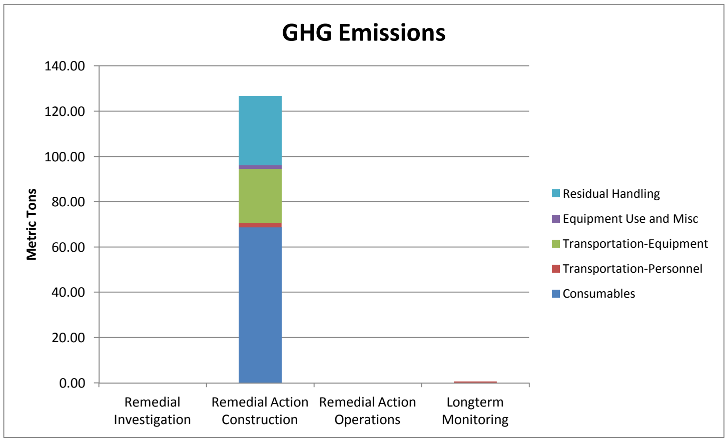
Phase	Activities	GHG Emissions	Total Energy Used	Water Used	NO_x Emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Remedial Action Construction	Consumables	6.93E+02	1.28E+04	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	1.04E+01	1.31E+02	NA	4.33E-03	1.4E-04	6.2E-04	2.7E-04	2.2E-02
	Transportation-Equipment	2.25E+02	2.93E+03	NA	7.06E-02	1.2E-03	6.3E-03	1.0E-03	8.4E-02
	Equipment Use and Misc	3.97E+01	5.21E+02	5.04E+05	2.73E-01	3.0E-02	2.3E-02	9.4E-04	2.4E-01
	Residual Handling	1.18E+03	1.54E+04	NA	2.00E+00	9.3E-01	5.0E+00	4.1E-03	3.3E-01
	Sub-Total	2.15E+03	3.19E+04	5.04E+05	2.35E+00	9.60E-01	4.98E+00	6.32E-03	6.70E-01
Longterm Monitoring	Consumables	0.00E+00	0.00E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	5.72E-01	7.19E+00	NA	2.12E-04	7.5E-06	4.3E-05	2.3E-05	1.9E-03
	Transportation-Equipment	0.00E+00	0.00E+00	NA	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.0E+00	3.2E-05	1.4E-02
	Residual Handling	0.00E+00	0.00E+00	NA	0.00E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	5.72E-01	7.19E+00	0.00E+00	2.12E-04	7.45E-06	4.29E-05	5.55E-05	1.57E-02
Total		2.15E+03	3.19E+04	5.04E+05	2.35E+00	9.60E-01	4.98E+00	6.38E-03	6.85E-01

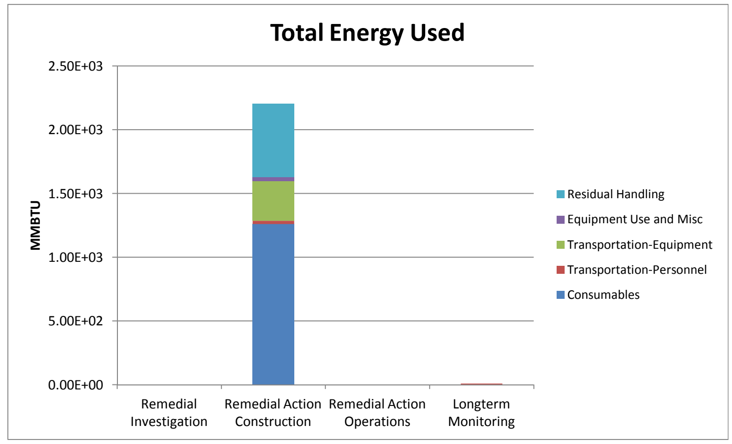
Notes:
MMBTU - million British Thermal Unit
NOx - Nitrogen Oxides
SOx - Sulfur Oxides
PM10 - Particulate Matter
NA - Not Applicable
GHG - Greenhouse Gases

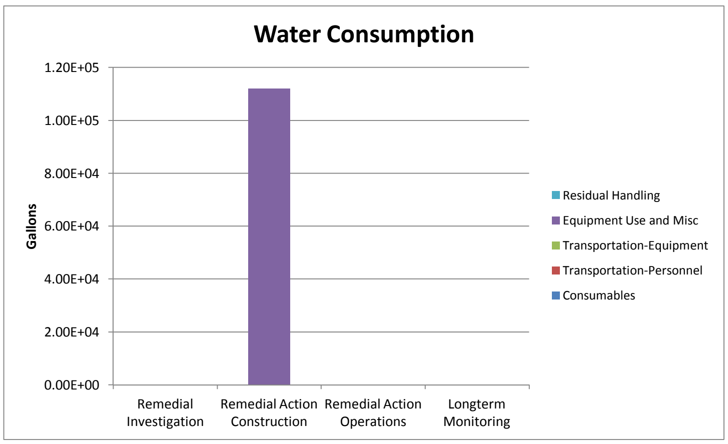
TABLE D-7
OABG Alternative 3 - Removal of Surface Debris, Excavation of AOCs, Ex Situ Treatment, Offsite Disposal, LUCs, and LTMgt
Site 1 (OU-4) Soil Feasibility Study
Allegany Ballistics Laboratory, Rocket Center, WV

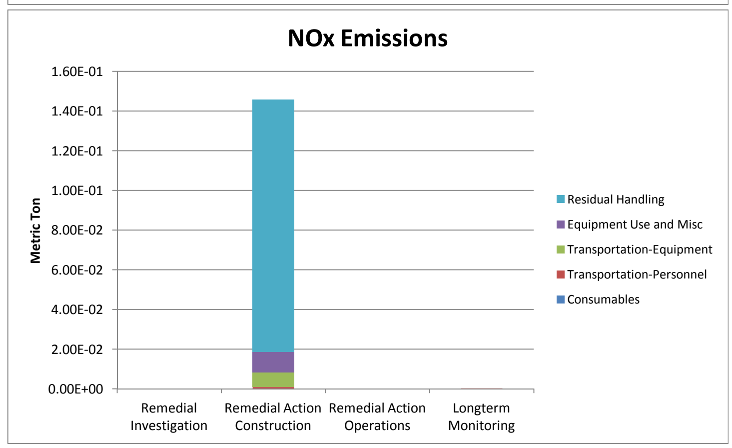
Phase	Activities	GHG Emissions	Total Energy Used	Water Used	NO_x Emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
		metric ton	MMBTU	gallons	metric ton	metric ton	metric ton		
Remedial Action Construction	Consumables	6.93E+02	1.28E+04	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	1.39E+01	1.75E+02	NA	5.8E-03	1.8E-04	8.2E-04	3.6E-04	2.9E-02
	Transportation-Equipment	2.28E+02	2.98E+03	NA	7.2E-02	1.3E-03	6.4E-03	1.1E-03	8.5E-02
	Equipment Use and Misc	2.33E+03	2.84E+04	1.80E+06	3.3E+01	1.3E-01	1.8E-01	1.3E-03	3.1E-01
	Residual Handling	4.00E+02	7.58E+03	NA	1.7E+00	8.8E-01	4.7E+00	5.0E-04	4.0E-02
	Sub-Total	3.67E+03	5.20E+04	1.80E+06	3.52E+01	1.01E+00	4.86E+00	3.17E-03	4.69E-01
Longterm Monitoring	Consumables	0.00E+00	0.00E+00	NA	NA	NA	NA	NA	NA
	Transportation-Personnel	5.72E-01	7.19E+00	NA	2.1E-04	7.5E-06	4.3E-05	2.3E-05	1.9E-03
	Transportation-Equipment	0.00E+00	0.00E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Equipment Use and Misc	0.00E+00	0.00E+00	0.00E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-05	1.4E-02
	Residual Handling	0.00E+00	0.00E+00	NA	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Sub-Total	5.72E-01	7.19E+00	0.00E+00	2.12E-04	7.45E-06	4.29E-05	5.55E-05	1.57E-02
Total		3.67E+03	5.20E+04	1.80E+06	3.52E+01	1.01E+00	4.86E+00	3.23E-03	4.85E-01

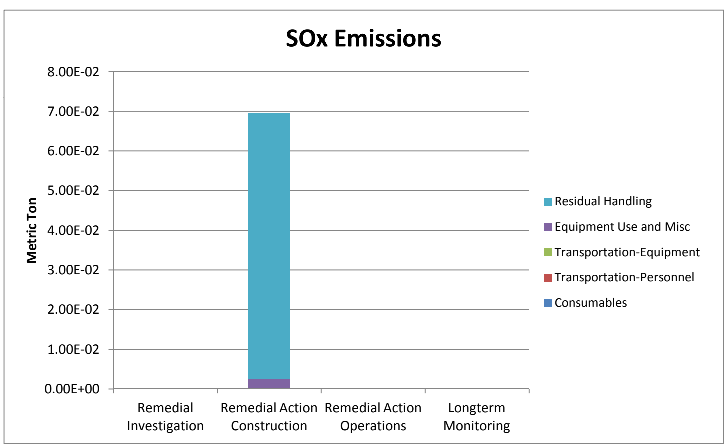
Notes:
MMBTU - million British Thermal Unit
NOx - Nitrogen Oxides
SOx - Sulfur Oxides
PM10 - Particulate Matter
NA - Not Applicable
GHG - Greenhouse Gases

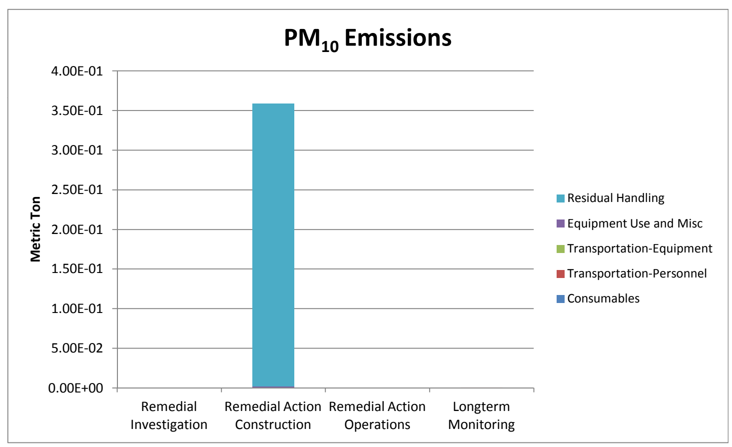

GHG Emissions
Metric Tons
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

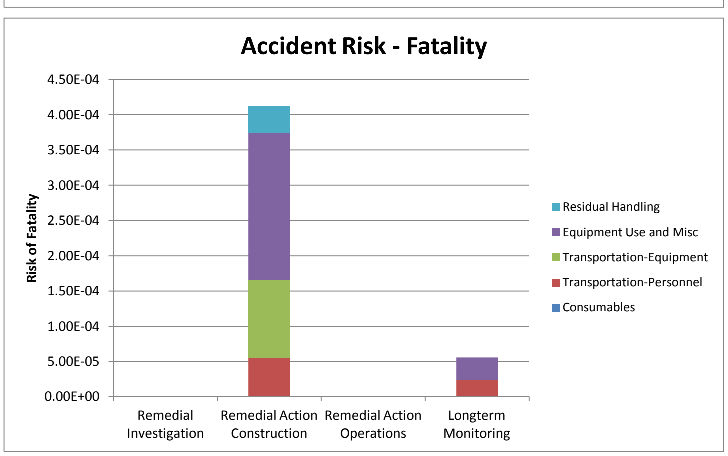

Total Energy Used
MMBTU
2.50E+03
2.00E+03
1.50E+03
1.00E+03
5.00E+02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

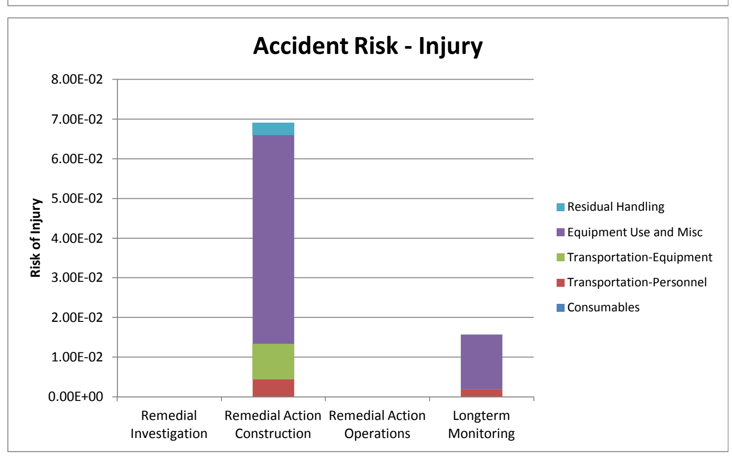

Water Consumption
Gallons
1.20E+05
1.00E+05
8.00E+04
6.00E+04
4.00E+04
2.00E+04
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

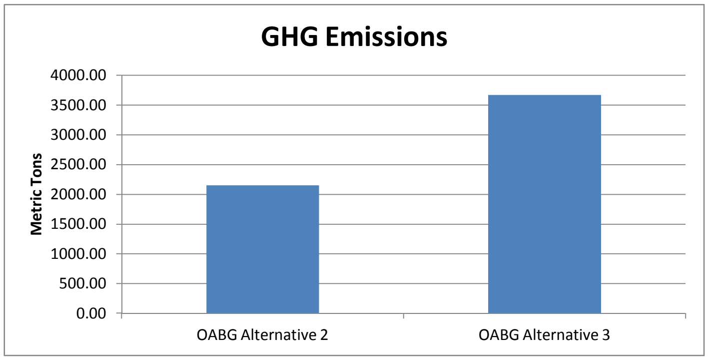

NOx Emissions
Metric Ton
1.60E-01
1.40E-01
1.20E-01
1.00E-01
8.00E-02
6.00E-02
4.00E-02
2.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

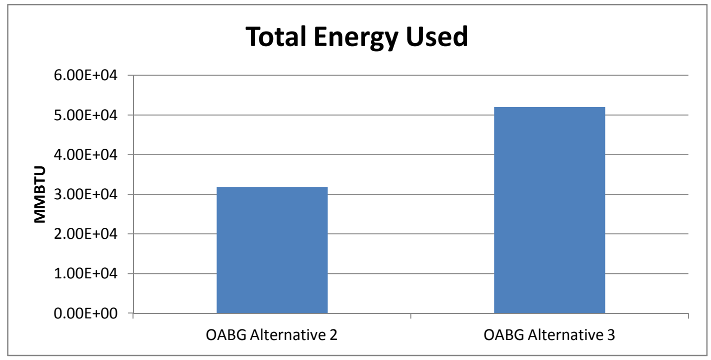

SOx Emissions
Metric Ton
8.00E-02
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

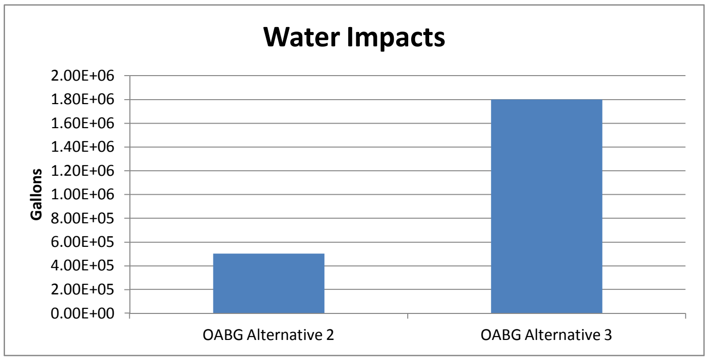

PM_{10} Emissions
Metric Ton
4.00E-01
3.50E-01
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

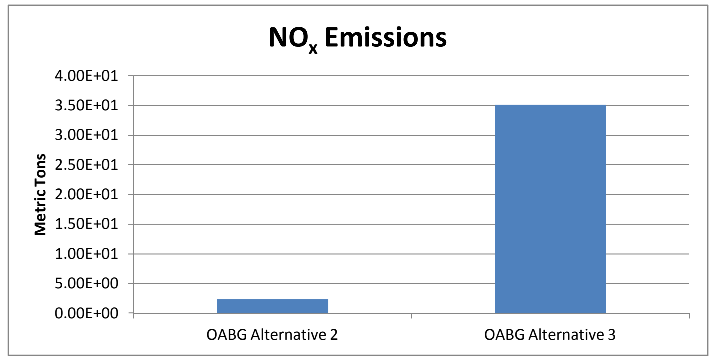

Accident Risk - Fatality
Risk of Fatality
4.50E-04
4.00E-04
3.50E-04
3.00E-04
2.50E-04
2.00E-04
1.50E-04
1.00E-04
5.00E-05
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

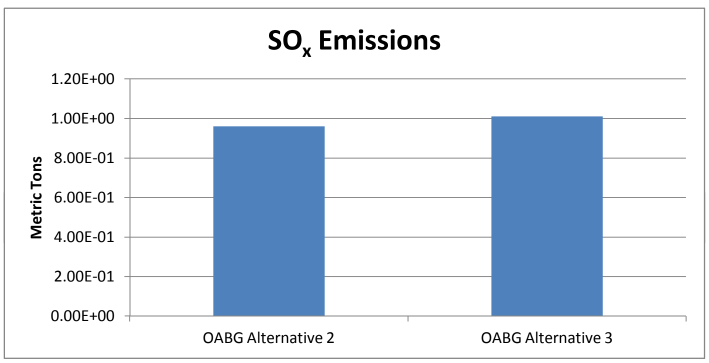

Accident Risk - Injury
Risk of Injury
8.00E-02
7.00E-02
6.00E-02
5.00E-02
4.00E-02
3.00E-02
2.00E-02
1.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

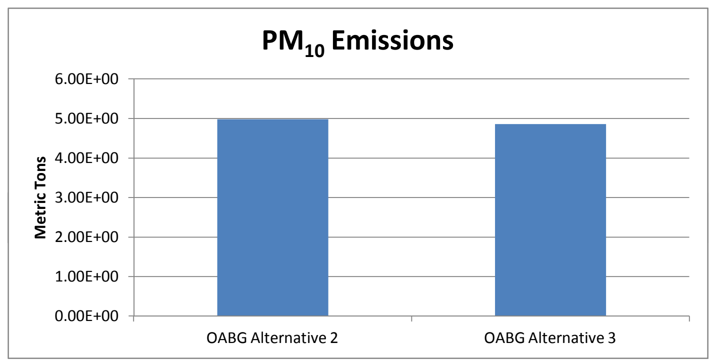

GHG Emissions
Metric Tons
4000.00
3500.00
3000.00
2500.00
2000.00
1500.00
1000.00
500.00
0.00
OABG Alternative 2
OABG Alternative 3

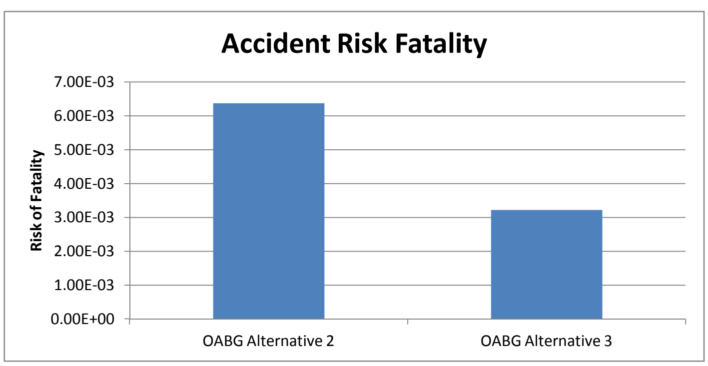

Total Energy Used
MMBTU
6.00E+04
5.00E+04
4.00E+04
3.00E+04
2.00E+04
1.00E+04
0.00E+00
OABG Alternative 2
OABG Alternative 3

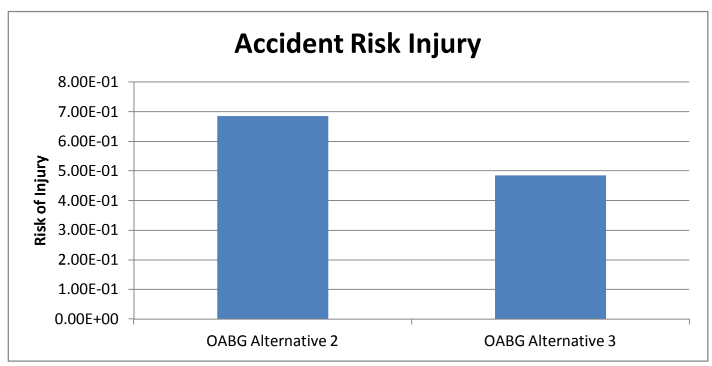

Water Impacts
Gallons
2.00E+06
1.80E+06
1.60E+06
1.40E+06
1.20E+06
1.00E+06
8.00E+05
6.00E+05
4.00E+05
2.00E+05
0.00E+00
OABG Alternative 2
OABG Alternative 3

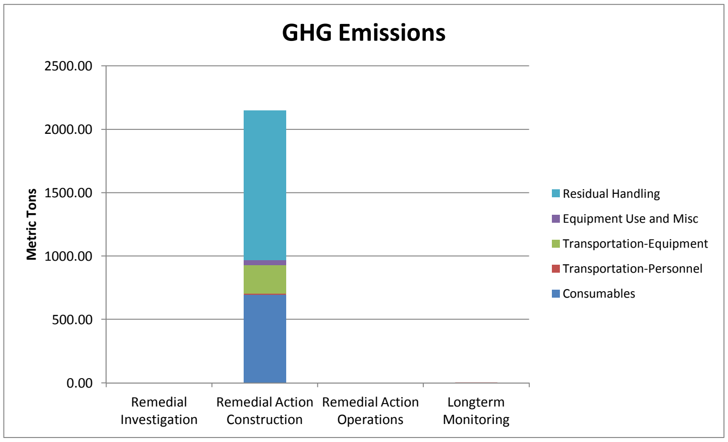

NO_x Emissions
Metric Tons
4.00E+01
3.50E+01
3.00E+01
2.50E+01
2.00E+01
1.50E+01
1.00E+01
5.00E+00
0.00E+00
OABG Alternative 2
OABG Alternative 3


SO_x Emissions
Metric Tons
1.20E+00
1.00E+00
8.00E-01
6.00E-01
4.00E-01
2.00E-01
0.00E+00
OABG Alternative 2
OABG Alternative 3

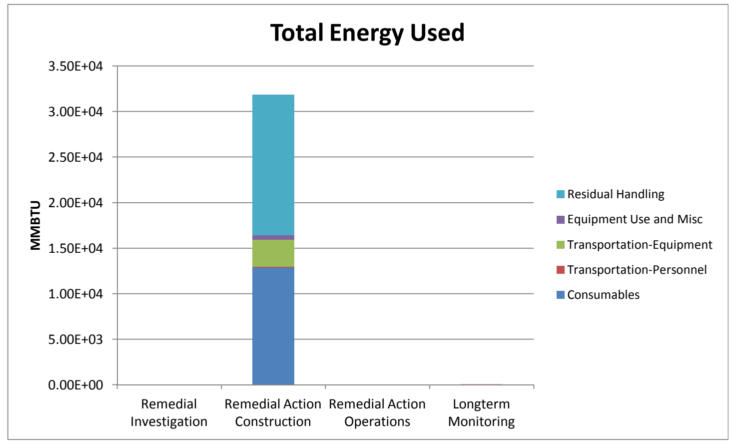

PM_{10} Emissions
Metric Tons
6.00E+00
5.00E+00
4.00E+00
3.00E+00
2.00E+00
1.00E+00
0.00E+00
OABG Alternative 2
OABG Alternative 3


Accident Risk Fatality
Risk of Fatality
7.00E-03
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
OABG Alternative 2
OABG Alternative 3

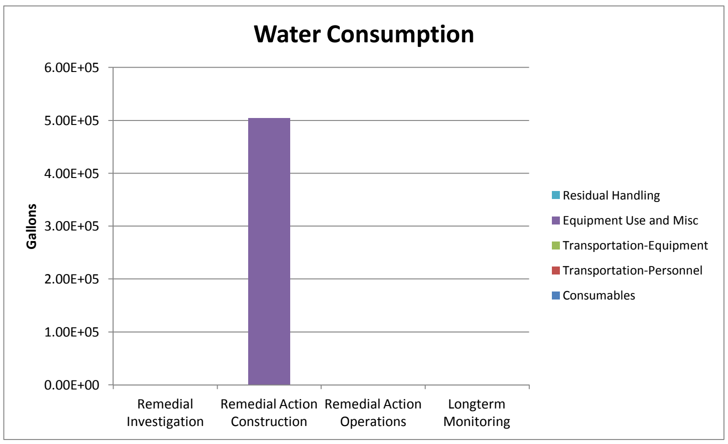

Accident Risk Injury
Risk of Injury
8.00E-01
7.00E-01
6.00E-01
5.00E-01
4.00E-01
3.00E-01
2.00E-01
1.00E-01
0.00E+00
OABG Alternative 2
OABG Alternative 3



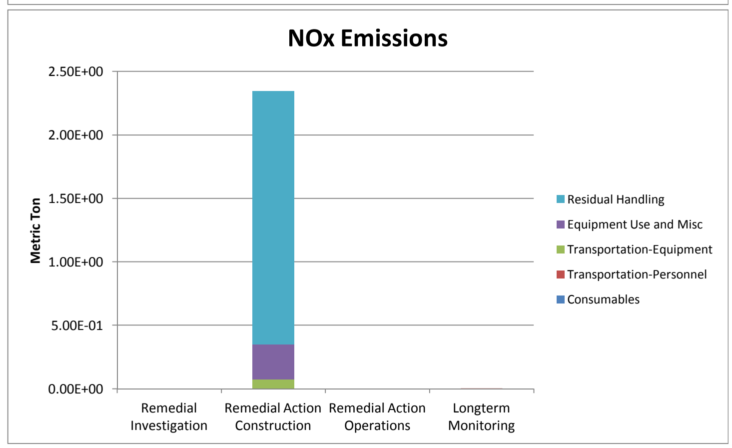
GHG Emissions
Metric Tons
2500.00
2000.00
1500.00
1000.00
500.00
0.00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables



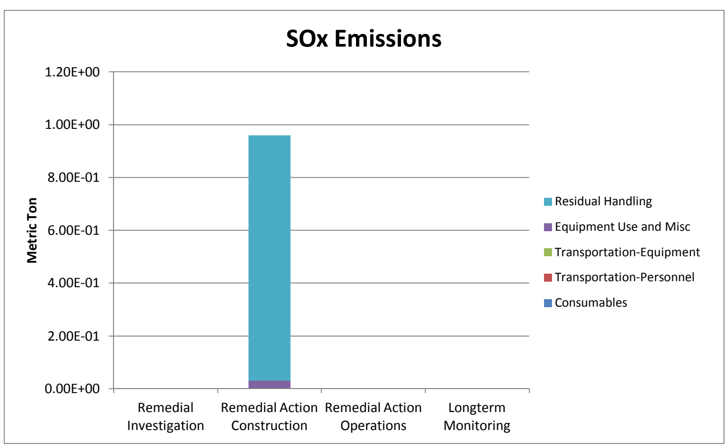
Total Energy Used
MMBTU
3.50E+04
3.00E+04
2.50E+04
2.00E+04
1.50E+04
1.00E+04
5.00E+03
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables



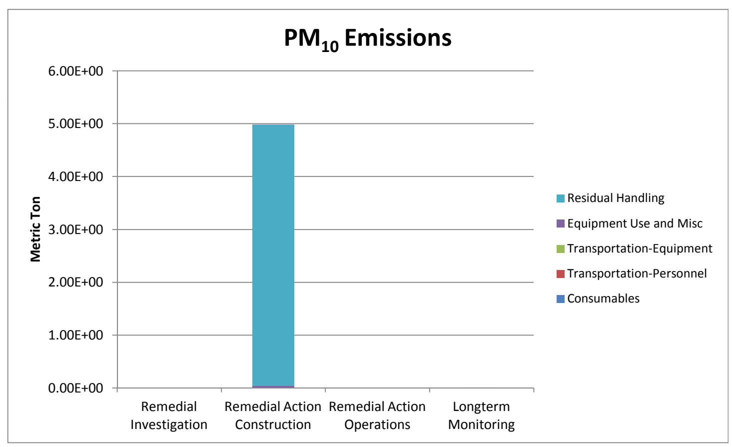
Water Consumption
Gallons
6.00E+05
5.00E+05
4.00E+05
3.00E+05
2.00E+05
1.00E+05
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables



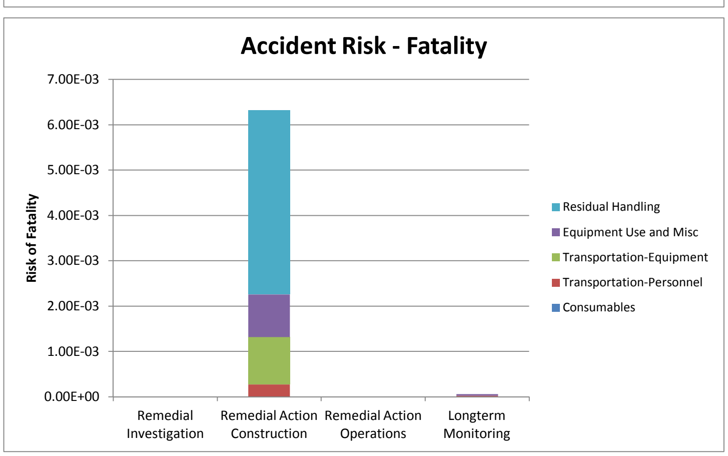
NOx Emissions
Metric Ton
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables



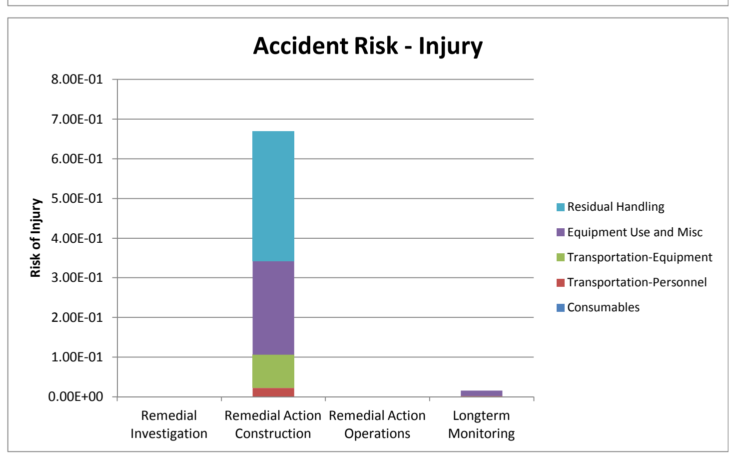
SOx Emissions
Metric Ton
1.20E+00
1.00E+00
8.00E-01
6.00E-01
4.00E-01
2.00E-01
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables



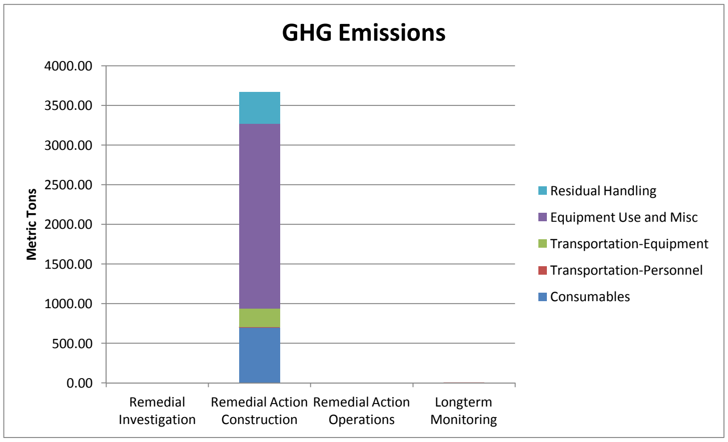
PM_{10} Emissions
Metric Ton
6.00E+00
5.00E+00
4.00E+00
3.00E+00
2.00E+00
1.00E+00
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables

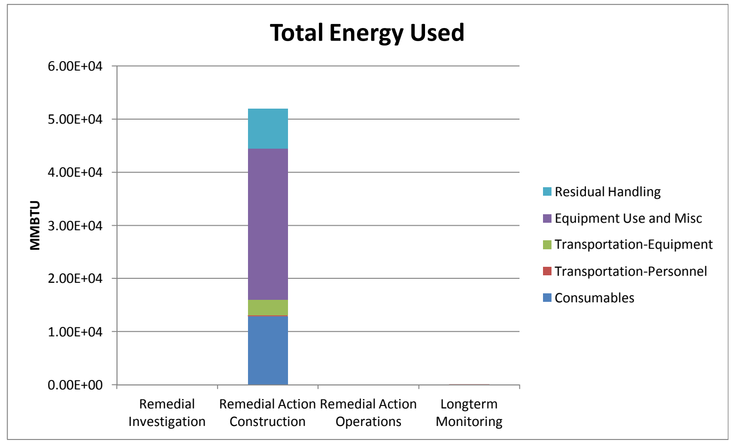


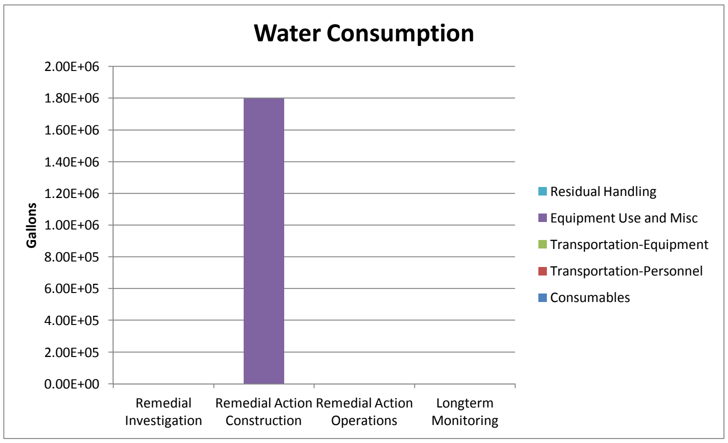
Accident Risk - Fatality
Risk of Fatality
7.00E-03
6.00E-03
5.00E-03
4.00E-03
3.00E-03
2.00E-03
1.00E-03
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables



Accident Risk - Injury
Risk of Injury
8.00E-01
7.00E-01
6.00E-01
5.00E-01
4.00E-01
3.00E-01
2.00E-01
1.00E-01
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


GHG Emissions
Metric Tons
4000.00
3500.00
3000.00
2500.00
2000.00
1500.00
1000.00
500.00
0.00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Total Energy Used
MMBTU
6.00E+04
5.00E+04
4.00E+04
3.00E+04
2.00E+04
1.00E+04
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Water Consumption
Gallons
2.00E+06
1.80E+06
1.60E+06
1.40E+06
1.20E+06
1.00E+06
8.00E+05
6.00E+05
4.00E+05
2.00E+05
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
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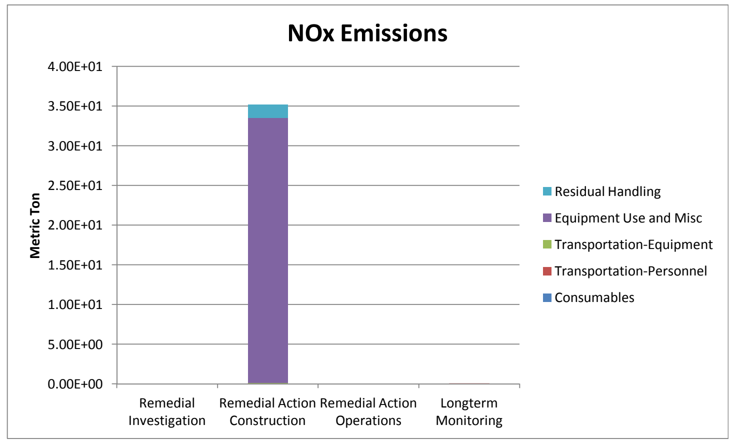
Transportation-Equipment
Transportation-Personnel
Consumables


NOx Emissions
Metric Ton
4.00E+01
3.50E+01
3.00E+01
2.50E+01
2.00E+01
1.50E+01
1.00E+01
5.00E+00
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
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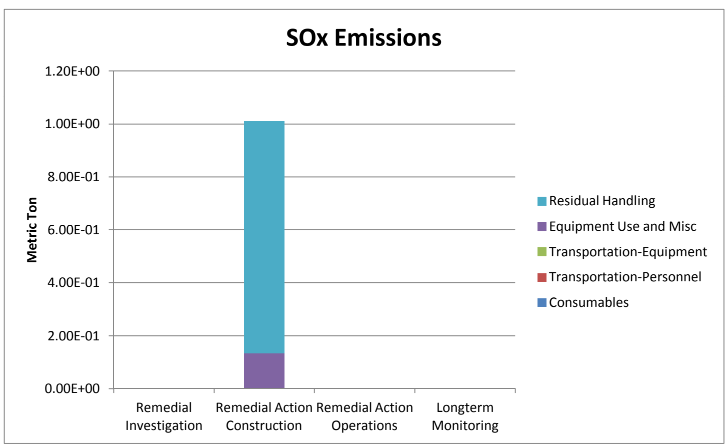
Transportation-Equipment
Transportation-Personnel
Consumables


SOx Emissions
Metric Ton
1.20E+00
1.00E+00
8.00E-01
6.00E-01
4.00E-01
2.00E-01
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
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Transportation-Equipment
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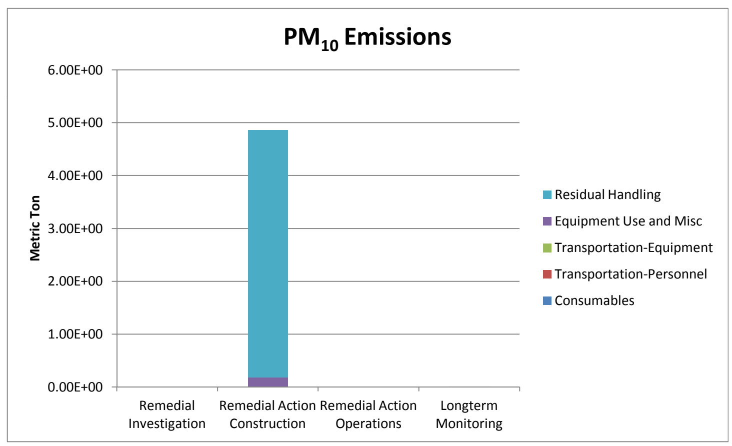
Consumables


PM_{10} Emissions
Metric Ton
6.00E+00
5.00E+00
4.00E+00
3.00E+00
2.00E+00
1.00E+00
0.00E+00
Remedial Investigation
Remedial Action Construction
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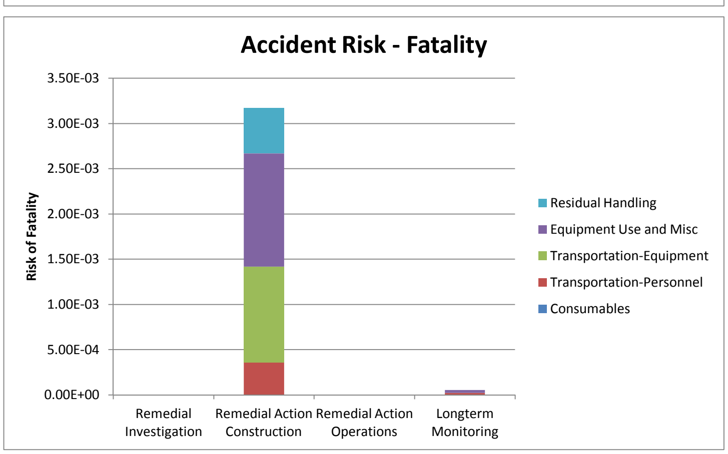
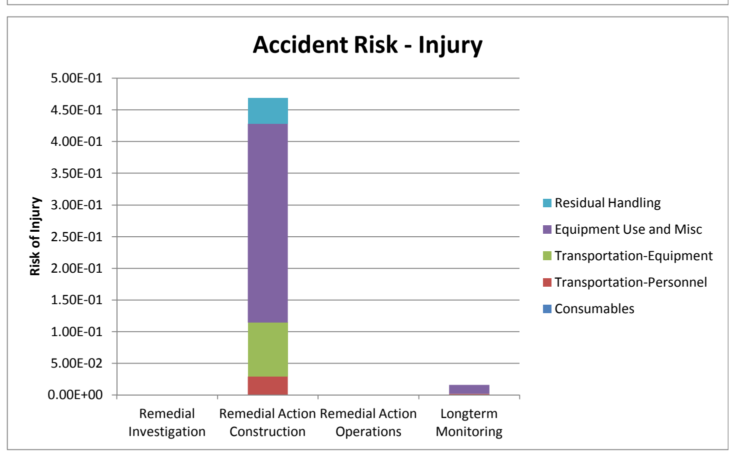
Transportation-Equipment
Transportation-Personnel
Consumables


Accident Risk - Fatality
Risk of Fatality
3.50E-03
3.00E-03
2.50E-03
2.00E-03
1.50E-03
1.00E-03
5.00E-04
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables


Accident Risk - Injury
Risk of Injury
5.00E-01
4.50E-01
4.00E-01
3.50E-01
3.00E-01
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
Remedial Investigation
Remedial Action Construction
Remedial Action Operations
Longterm Monitoring
Residual Handling
Equipment Use and Misc
Transportation-Equipment
Transportation-Personnel
Consumables